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EDITED BY WALTER HOWCHIN, F.G.S.

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THE GLACIAL (PERMO-CARBONIFEROUS) MORAINES OF ROSETTA HEAD AND KING'S POINT, SOUTH AUSTRALIA.

By WALTER HOWCHIN, F.G.S., Lecturer in Geology and Palæontology in the University of Adelaide

[Read April 5, 1910.]

PLATES I. to XVII.

The coastline from the mouth of the River Murray to King's Point, a distance of little more than twenty miles, is one of the most varied and interesting portions of the southern sea-board of South Australia. The low foreshore of Middleton; the prominent headlands of Port Elliot, Rosetta Head, and King's Point; the picturesque islands that festoon the coast; and the serrated schists that occupy the beach between Rosetta Head and King's Point make this section of the coast rich in contrasts and of great scenic beauty.

This locality is, moreover, a centre of interest, more profound and far-reaching than the merely picturesque. Here are the remnants of an extensive but vanished highland which in the far past had its snow-covered peaks and outspreading rivers of ice—ice that spread in one continuous sheet from the valley of the Murray to Spencer Gulf, choking the valleys and overstepping the secondary watersheds in its flow towards the northern plains. The morainic material carried by this ice-sheet was enormous, and notwithstanding that much of it has been removed by subsequent denudation, enough has been left in sheltered situations to give us some idea of the magnitude of the ice-flood.

My present purpose is to deal with only a very small portion of this great extinct glacial field, *viz.*, a description of the moraines which found a shelter on the leeward side of what are now two headlands facing the Southern Ocean.

I do not wish by the title of this paper to convey the impression that Rosetta Head and King's Point were responsible for the origin of separate and exclusive glacial deposits. The moraines which stretch northward from the Bluff and King's Point were certainly influenced by local contours, but at the same time they formed part of the one great glacial mud-deluge which in Permo-Carboniferous times flowed over the whole of what is now the southern districts of South Australia. The excuse for dealing with this subject in a sec-

tional way, so far as the present paper is concerned, is that the deposits now under description exhibit two of the most perfectly-preserved examples of Permo-Carboniferous moraines that have come under my notice.

ROSETTA HEAD MORAINE.

Rosetta Head, or the Bluff as it is more commonly called, possesses a striking profile. It is a rounded hill, 317 ft. in height, washed by the sea on three of its sides, and on the landward exhibits a steep and broken crest, which passes into a low, smooth curve at about half the elevation of the hill, thereby giving an easy access to the summit (see plates iii and iv.). The south-eastern side of the hill gives a very fine illustration of intrusive granite weathered into huge masses and spheroidal blocks. On the landward side the granite forms a junction with fine-grained mica-schists, the latter being intimately penetrated with strings and shots of granite, while at greater distances from the igneous rocks there are conspicuous quartz-veins and "blows." The schists, in their landward extension, are largely obscured by a covering of clay and large boulders which can be traced from the slopes of the Bluff to an indefinite distance in a northerly direction.

The dissimilar features of the two sides of the Bluff arise from a geological unconformity of high-time value. The seaward side, as well as the summit, consists of metamorphic schists intimately penetrated and contorted by granitic veins. The landward slopes are formed of a wide ridge of morainic material which, although dating from the Palæozoic age, has scarcely been altered from its original incoherent condition during the many geological periods that have transpired since its deposition.

The Bluff originally formed part of an east and west ridge that possessed steep faces towards the north. These scarps, facing the north, form parts of the old-world topography which the ancient ice-sheet impressed on the district. It is a characteristic feature of glacier movement that the ice exerts the greatest denuding force at the further extremities of a hill in the direction of its own flow. In such situations the rocks have less powers of resistance, and are cut into and carried away by the ice-plough under a process of "plucking."

An escarpment of the kind just mentioned would, under the influence of an ice-flow, tend to produce two classes of effects: firstly, a large amount of material for transportation, gathered from the wearing back of the scarp; and secondly, a lee-face, under the protection of which morainic

material would have a tendency to accumulate. These two features are well illustrated in the case of the Bluff, *viz.*, a broken or "plucked" face in the direction of the flow, and a great accumulation of erratics and glacial-till on the landward side—that is, on the lee-side of the hill.

By reference to the map (plate i.) it will be seen that a ridge of older rocks (Cambrian) divides the morainic deposits of Encounter Bay from similar deposits on the Waitpinga or western side of the ridge This dividing ridge forms an inlier of the glacial beds, and was, until exposed by denudation, entirely covered by glacial deposits. Outliers of the latter can still be found in patches along the sides and on the crest of the ridge. One such occurs in Section 180, Hundred of Encounter Bay, where a group of erratics can be seen in a paddock on the east side of Hall's Creek Road.

Confining our attention at present to the eastern side of this dividing ridge, the morainic material forms a nearly continuous sheet, sculptured into foothills and terraces, extending from the Bluff to Glastonbury Hill, at the entrance to the Inman Valley. The moraine is seen on the beach, in places, at Encounter Bay, where it helps to form a remarkable reef which extends nearly a mile seawards and is largely bared at low tide (plate iii). At the higher elevations the glacial deposits consist mainly of sand or sand-rock, but in the main trail from the Bluff the beds are a stiffish clay, forming good wheat-land, which is sometimes stony and contains large erratics. Good sections of this boulder clay can be seen in the creeks, and especially in washouts, which are easily developed in the cultivated ground. A washout in Section 177, Hundred of Encounter Bay, is several hundreds of feet long and, in places, 30 ft. deep.

In plate ii., fig. 2, a longitudinal sketch-section of the Rosetta Head moraine is given. The main portion of the Bluff consists of granite, but on the landward-side there is an outcrop of schists which occupy the mid-distance of the ascent, and at lower levels these are obscured by the prevalence of glacial drift. The glacial beds make a curve on the lower slopes of the Bluff and pass into an irregular ridge, resting on an uneven floor of the older rocks.

The ice-plough in passing over the Bluff cut deeply into the schists, producing a hollow in the rocks by "over-deepening" its floor. The excavation was brought about partly from the high gradient of the glacier's path and partly from the more yielding nature of the schistose rocks as compared with the granite. This ice-cut hollow is now occupied by glacial drift (plate ii.), extending from the Bluff for about a quarter of a mile. Some very large erratics are exposed

in the boulder clay. One, for example, situated at about half-distance between the Bluff and the inlier of schists, measures 14 ft. by 9 ft. The thickness of the boulder clay, as well as the foreign character of some of the erratics, is sufficient evidence that the deposit is not wholly of local origin.

Beyond the ice-cut rock-basin, just described, the schists come again to the surface in the form of a rounded boss, level with the general contour of the ridge, and dip under the glacial drift on all sides except the east, where they have been truncated by the sea and form low cliffs. Beyond this point, the section, except where the line passes over a spur of the old rocks, shows an unbroken extension of the moraine to Glastonbury Hill, on the road to the Inman Valley, a distance of three miles from the Bluff.

There is little to distinguish the general features of the moraine, as seen in its various sections, except the greater or less prevalence of its erratics. In Sections 7 and 8, Hundred of Encounter Bay, close to the beach road, there is a very fine example of a stony moraine, where a score or more of large erratics, partially uncovered, can be seen in a bank of till (plate v.).

In Section 177, on the west side of Waitpinga Road, there is a great field of large erratics. At the south angle of this section a 30-ft. washout, already referred to, has exposed more than a dozen of these large boulders sticking in the clay faces of the washout or resting on the bottom. Groups of granite boulders occur in different parts of this paddock, and near the northern fence, at the bend of the Inman Valley Road, where it rises to Glastonbury Hill, a long line of over twenty large boulders can be seen (plate vi.). The moraine can be traced up the sides of this hill, chiefly on the eastern side of the road, where it merges into the Inman Valley deposits.

The sea has operated on the soft morainic material to such an extent that a considerable bay has been created by its encroachments, extending from the Bluff to the Port Elliot headland. Within recent geological times glacial clay formed the sea-cliffs throughout the greater part of this distance. The recent elevation of the seaboard has placed these old sea-cliffs beyond the reach of the waves; but they can be readily recognized between the Hindmarsh River and Port Elliot, and also between Encounter Bay and the Bluff, where the road runs between the old sea-cliffs and the sea on a low shelf sixty yards wide.

This waste of the glacial till by the encroachments of the sea has had the effect of strewing the beach and shallow water

with a great assemblage of boulders, the latter having been left, whilst the finer material has been washed away. These boulders are especially numerous in the protected cove at the back of the Bluff at a distance of about half a mile from the latter. Here there are hundreds of large erratics between tide-marks and also on land at or near the base of the moraine cliffs (plates vii., viii., and ix.). By far the greater number of these are granitic and chiefly of the local type. There are, however, other granites and some sedimentary rocks represented which are not local. Very siliceous quartzites occur among the erratics. On the beach near highwater-mark three masses of quartzites lie in close proximity to one another, measuring respectively 8 ft., 6 ft., and 4 ft. in their longer diameters. One large quartzite between tides has attached to it a bed of brecciated marble 1 ft. in thickness. One boulder of fine-grained, pink-coloured granite 3 ft. in length is highly glaciated and polished. Some of the granites are of exceptional size. One of these, on the beach, which is falling apart along joint-planes, measures 23 ft. in length (plate ix.). These beach erratics are most plentiful opposite to the old cliffs where the sea has encroached on the moraine, and for a distance of half a mile of coast they are in countless numbers.

A suggestion might be made by some that these boulders, which are mostly granite, were worn from the Bluff in the ordinary course of subaerial waste, and subsequently transported along the beach by wave action The evidence, however, does not favour this view. It would follow as a natural order of things that the ice-sheet in passing over the granitic ridge (of which only isolated fragments remain in the headlands and islands) would quarry the stone and carry it forward. The immense quantity of this granite, which is spread over hundreds of square miles of the inland districts, is sufficient evidence of this; but the presence on the beach of numerous stones foreign to the locality indicates the work of an agent more far-reaching than wave action. Neither can we assume that the granite boulders have been derived from granite dykes penetrating the schists on which many of them rest. The schists, except in a narrow zone where they form a junction with the granite, are quite free from granitic intrusions. Moreover, if we refer the beach boulders to ordinary local waste and transport, there ought to be a long train of these stones, most numerous at the base of the Bluff and gradually thinning off with distance from this source. It is, however, not so. Between the Bluff and the great field of beach erratics there is half a mile of coast along which granite boulders scarcely occur, whilst the greatest

numbers are found in close proximity to the old sea-cliffs of glacial till, in which similar granites to those on the beach can be found *in situ*.

Between Encounter Bay and the River Inman there are low-lying flats of recent origin. They extend from the base of the moraine to the sea, and are often more or less submerged in winter by the drainage from the hills, when the water accumulates behind the coastal sandhills. In these flats there are deposits of white to dark-coloured marlstones, consisting largely of the brackish-water shell, *Coxiella badgerensis*. The deposit in its present indurated condition is a marly limestone, and is used for building purposes as well as for road-metal. These estuarine shells give evidence of permanent lagoons behind the sandhills within recent times, the water being retained, no doubt, by the underlying impervious glacial clay. The limestone is capped by a thin deposit of travertine which has been laid down under drier conditions in later times. That the glacial moraine once occupied the position and now underlies these flats is rendered probable by the occurrence of erratics within the area. One of these can be seen a little north of the old cemetery, in the angle of Section 81, close to the road; and a smaller one, a little north of the one just referred to, on the Encounter Bay road. Further evidences of the extension of the glacial beds eastwards are supplied by the fact that clay is sometimes exposed on the beach, and also by the presence of a large granite erratic stranded almost opposite the mouth of the Inman River.

King's Point Moraine.

The sea-beach between Rosetta Head and King's Point is extremely rocky. Dark-coloured schists occupy the beach in sharp ridges and make cliffs from 30 ft. to 50 ft. in height. On the top of the sea-cliffs there are morainic deposits which are continuous from Rosetta Head to King's Point (plate iv.). Here the moraine is about half a mile in width, being limited by a ridge of old rocks parallel with the coast and forming its background. This coastal strip is under cultivation, and is dotted with erratics. For the first three-quarters of a mile from the Bluff the erratics are not numerous, but at the distance named a small bay is reached in which a large number of granite boulders is grouped on the beach and also on the top of the adjacent cliffs. From this point the erratics again become scarcer until near King's Point, when they once more increase in numbers under the influence of the new trail connected with the latter.

King's Point is a headland situated one and a half miles to the south-west of Rosetta Head (plate x.). West Island,

a fragment of the granitic ridge, was at no very distant date joined to the mainland at King's Point, from which it is now separated by a sea channel of about half a mile in width. According to the Admiralty Directory the island is 132 ft. in height, which is a little higher than the highest point of the moraine at King's Point. The island has a remarkably even and rounded contour, suggestive of having been subjected to glacial erosion (plate xi.).

West Island appears to stand in a similar relation to the moraine of King's Point as Rosetta Head does to the moraine of Encounter Bay, as already explained. In the case of King's Point, the sea-channel and adjacent land represent the rock-trough (or "over-deepening") cut out by the glacier on the down-flow side, and there is also present an undulating floor of schists with morainic debris in protected situations. The schists (which are mostly fine-grained mica-schists similar to those at the back of Rosetta Head) are relatively soft, and owe their preservation, as a headland, to the protection which West Island affords. A similar process of cutting into the schists is in evidence at the back of Rosetta Head; an isthmus is being formed by encroachments of the sea behind the granite ridge, and, in time, Rosetta Head will be disconnected from the mainland in the same way as West Island has become. It is fortunate that King's Point has been preserved from the levelling action of the waves, as it exhibits, notwithstanding its great geological age, an example of a moraine which might be regarded as typical of those laid down by existing glaciers.

In plate ii. a sketch-section of the moraine is given, so far as it is seen within the limits of King's Point. The schists occur as strong reefs on the beach, and show an elevation at the head of the Point of about 20 or 30 ft. above sea-level. The original outline of these old rocks was probably in the form of a dome, as they have a slope on the landward side and disappear under the moraine, about one-third distance between the Point and the normal line of cliffs. The promontory rises gradually from the point until, when in a line with the usual contour of the sea-cliffs, it reaches a height of 100 ft. With the exception of a part of the headland, as just described, the whole of the promontory consists of morainic material.

The moraine, whilst in remarkable preservation as a whole, has been cut into by the weather. The upper surface has been lowered and its sides have been seamed by running waters. The small gullies thus formed give interesting sections of the beds, and the removal of the finer material

has led to a concentration of its stony contents It consists of two main beds:—

(a) An upper bed of loosely-cemented sand 22 ft.
(b) A lower bed of stony clay (till) ... 78 ft.

The upper bed *(a)* might be classed as a sand-rock argillaceous in part and of various colours - white, yellow, and red. Usually, it is either a dark-red colour or mottled arising from the presence of iron oxides, which by segregation has led to the formation of ferruginously-cemented sands, either in layers or local segregations—a very common feature of the glacial sandstones and conglomerates of this period as they occur to-day in South Australia. The bed contains a few stones of small size, and these are usually more or less water-worn. Infiltration has led to the formation of a great number of stalactitic pipes in the upper part of the bed, probably following the occurrence of roots and other organic matter in the subsoil.

The wind and rain have deeply eroded this bed, which forms the cap of the moraine. Some parts have been excavated to the level of the underlying clay, and there are outliers of the same material scattered over the summit, with glacial clay exposed between them (plate xii.). At the landward end, where the moraine gently rises to higher ground, there is a continuous cliff of the sand-rock, 20 ft. in height. Here the bed gives some slight indications of being stratified. It is possible that this upper member of the section had its origin in the redistribution of morainic material, under the action of water, at a period subsequent to the ice-flood. On the other hand, this bed closely resembles the glacial sandstones which occur interstratified with glacial clays in other parts of South Australia. If it were of contemporary date with this particular glacial period, it certainly suggests altered conditions from those which prevailed during the deposition of the underlying boulder clays. The power of vigorous transport had ceased, and only fine material could, as a rule, undergo carriage. It may represent a late stage of the glacial period when, along the face of the retreating ice-sheet, water became the chief agent of deposition.

The lower bed *(b)* exhibits the features of a typical glacial till or boulder clay. The clay generally carries a certain proportion of sand and is very stony, the stones ranging from the size of pebbles to many feet in diameter. The summit of the moraine is nearly flat, except for the unevenness which is the result of erosion. Where the surface has been worn down to the underlying clay bed an extraordinary assemblage of large and small boulders strew the

ground (plate xii.), several of which have diameters of 7 and 8 ft. One granite boulder occupies a perched position on the edge of the main gully facing east, which gives it a striking appearance when viewed from the beach (plates xiii. and xiv.). This erratic has been much larger than it is at present, having exfoliated and thrown off an outer shell which is about 4 in. in thickness In its reduced form it has the shape of a nearly round boulder 8 ft. in diameter. The boulder rests on undisturbed till.

In a small tributary of the main gully just mentioned a very stony face of glacial till is exposed, including some fairly large erratics. A group of still larger erratics stands out conspicuously near the upper part of the moraines facing the sea (plate xiv.). A small washout on the south side near the summit of the moraine contains a very interesting group of boulders, some of which show evidences of glaciation (plate xvi.).

The majority of the large erratics belong to the local type of granite—a very coarse, pinkish-coloured granite, with numerous large porphyritic crystals of felspar, many of which have undergone corrosion, and take the appearance of pseudo-pebbles. These granites also sometimes show inclusions of the local schistose rocks, fragments of the latter having been caught up into the magma before its consolidation. The other classes of erratics, mentioned in the order of the frequency of their occurrence, are fine-grained, highly-coloured pink granites, and fine-grained grey granites. Quartzites of several types also occur. Some of these are white, laminated, and of saccharoidal texture. One specimen of this class measures 4 ft. in length. Other examples of quartzite are bluish in colour and very siliceous. Among the smaller erratics were noticed aplites, quartz-porphyry, and a few examples of the local schists. Small drifts of blown sea-sand occur in places on the sides and also on the summit of the ridge.

A conspicuous feature of the morainic material here, as well as in other parts of South Australia where Permo-Carboniferous glacial deposits occur, is the presence of highly water-worn gravel, apparently beach-worn. The commonest varieties represented among these rounded stones are quartzite, quartz, granite, and a few schistose pebbles. Many of these show some form of glaciation, as, for example, a high polish, or have been strongly ground on one side ("soled"), and in a few instances exhibit well-marked glacial striæ (plate xvii.). I do not intend to discuss the origin of these sea-worn pebbles of the glacial drifts in the present paper—that will come more appropriately at a later stage, when I hope

to be able to place additional evidence on this interesting subject before the Society.

The beach on the east side of the Point is thickly strewn with erratics, which are of large size and in considerable variety. It is remarkable that at the extreme point of the headland, where the schists form reefs running in the direction of West Island, there are no erratics on the coast; but within the bays on either side of King's Point ice transported stones are extremely common. The barren ground next the island has been sea-swept, and a thickness of 30 ft. of schist removed by wave action, which has also disposed of the morainic material which capped these schists. The source of the erratics in the bays on either side of the Point can be readily traced to the glacial clay which comes down to the beach in immediate proximity to these boulders.

The rounded hummock of schist, which has been cut into by the sea at the extreme point, and passes out of sight under the moraine on the landward side, probably received its rounded form under ice movement; but no evidence of a polished pavement could be detected on its surface. When we consider the soft and friable nature of the mica-schist which formed the floor of the glacier this absence of the evidences of glaciation cannot be wondered at. A stone of this kind could neither take a fine polish in the first instance nor retain it against the weathering action of subsequent ages. Clear evidence of glaciation was, however, obtained from the erratics, as already stated.

Conclusion.

Both the moraines described in this paper illustrate the important effects produced by hard prominences in conjunction with soft rocks in promoting morainic aggradation. The increasing ice-sheet became in time an "ice-flood" with high erosive energy directed towards deepening its bed and transporting its debris. On meeting the hard granitic barrier that ran east and west its quarrying power was checked; but passing over this strongly-resisting rock, it immediately plunged into the yielding schists and excavated its path in them below the normal level. When the ice age was passing away and the ice-sheet shrinking back to the greater elevations the power to erode was lost, the rock basins gradually becoming choked by the material which the glacier had no longer power to scoop out from the deeper levels. This was the age of aggradation, a levelling-up of the uneven floor of the glacier by the load it was no longer able to carry to the regions beyond.

Then, finally, long after the last of the glaciers had disappeared and the denuding forces of subsequent ages cut deeply into the boulder clays which choked the valleys, these moraine-filled hollows were doubly protected: firstly, on account of their low-lying position, which made them the last to come under the influence of subaerial waste, and, secondly, from the existence of the hard granitic ridge, on the up-stream side, which ridge in the first instance led to the excavation of the hollows in the softer rocks, and now stands guard over them in delaying the processes of waste. Rosetta Head has played this rôle, as pointed out, in the one case: and West Island, although now severed from the mainland, has done a similar thing in the history of King's Point moraine, as shown in our second illustration.

DESCRIPTION OF PLATES.

PLATE I.

Map of the district described in the paper, showing the morainic areas associated with Rosetta Head and King's Point.

PLATE II.

Sketch-sections of the moraines at Rosetta Head and King's Point.

PLATE III.

Rosetta Head (the Bluff) and ridge of morainic material as seen from Encounter Bay. Littoral reef of limestone is seen in the foreground.

PLATE IV.

Rosetta Head as seen from King's Point; also moraine and erratics overlying the cliffs of Cambrian schists which connect the two headlands.

PLATE V.

Rosetta Head moraine, with erratics, seen in transverse view, near Encounter Bay.

PLATE VI.

Group of granite erratics, in lineal order, near the base of Glastonbury Hill, Inman Valley Road.

PLATE VII.

Group of erratics in shallow water, Encounter Bay. The boulders have been left by the retreat of cliffs of boulder-clay worn away by the sea.

PLATE VIII.

Great field of erratics, situated between high and low water marks, washed from boulder-clay, Encounter Bay.

PLATE IX.

The largest erratic on the coast at Encounter Bay, measuring 23 ft. in length It is of porphyritic granite and is breaking up along joint planes.

PLATE X.

King's Point as seen from the east. With the exception of the basal part of the extreme point it is entirely composed of morainic material.

PLATE XI.

West Island, off King's Point, at a distance of half a mile from the latter. Shows an ice-smoothed outline.

PLATE XII.

Summit of the moraine at King's Point. A ridge of the upper (sandy) beds is seen at the back, and a number of large erratics resting on boulder-clay in the foreground.

PLATE XIII.

View of the eastern side of the moraine at King's Point, with a large perched boulder near the summit.

PLATE XIV.

The large boulder seen in Plate XIII. at a nearer view. The erratic, which is 8 ft. long, is of granite and rests on undisturbed glacial till.

PLATE XV.

King's Point moraine, facing the sea, showing a group of large erratics near the summit and a washout in glacial till on the left-hand side.

PLATE XVI.

The washout on left-hand side in Plate XV. at a nearer view, showing the stony character of the till.

PLATE XVII.

Two examples of glaciated stones from the King's Point moraine. About half natural size.

Descriptions of Australian Curculionidæ, with Notes on Previously Described Species.

Part VIII.

By Arthur M. Lea.

[Read June 7, 1910.]

SUBFAMILY OTIORHYNCHIDES.

Merimnetes fagi, n. sp.

Reddish-brown, appendages paler. Densely clothed with fawn-coloured scales, frequently with a golden or golden-green gloss, and usually mottled or spotted with brown. In addition with numerous suberect setæ, varying from white to black, and usually forming a single row on each elytral interstice.

Rostrum with three carinæ, of which the median one is sometimes entirely concealed. First joint of funicle almost as long as second and third combined. *Prothorax* granulate-punctate, or somewhat vermiculate. *Elytra* ovate; with series of large, partially-concealed punctures; suture, third and fifth interstices feebly raised. Length (excluding rostrum), 4½-6¼ mm.

Hab.—Tasmania: Hobart, Launceston, Burnie, Sheffield, Stonor, Mole Creek (A. M. Lea).

In general appearance rather close to *australis*, but smaller and somewhat wider, antennæ somewhat shorter, etc.

The bulk of the specimens appear to have the derm of a reddish-brown, but occasionally it is almost black. On the prothorax there is usually a rather feeble dark median stripe, and a shorter one on each side of the base. On the elytra the spots or mottlings are generally rather numerous, but not sharply defined or constant in position; there are generally also some dark spots on the abdomen. Most of the specimens were taken from the so-called native myrtle *Fagus Cunninghami*.

Numerous specimens from Waratah and two from Ulverstone differ in having the elytral setæ less erect, but I can find no features sufficient to be regarded as of specific importance.

In this and all the following species the rostrum is separated from the head by a transverse suture (sometimes almost concealed). Between the eyes there is a narrow longitudinal impression (also more or less concealed). The males differ from the females in being smaller, with the prothorax

less transverse, the elytra more convex, narrower and less ovate, with large punctures and narrower interstices, and the legs and antennæ longer. The basal segment of the abdomen also differs sexually, in some species being concave in the male and flat in the female, or flat in the male and convex in the female.

MERIMNETES SIMPLICIPENNIS, n. sp.

Reddish-brown, appendages paler.

Rostrum with very feeble and normally quite concealed carinæ. First joint of funicle as long as second and third combined. *Prothorax* with sides rather strongly rounded; with numerous, somewhat irregular, and more or less concealed granules, with a feeble median line. *Elytra* oblong-ovate; with regular rows of large, partially-concealed punctures; interstices not alternately raised. Length, 7¼-7½ mm.

Hab.—Tasmania: Mount Wellington, Hobart (A. M. Lea).

Very close to *australis*, but both sexes slightly wider, the suture not subcarinated posteriorly, and the third and fifth interstices not at all raised above their fellows, but quite uniform with them. The elytral setæ also are almost uniformly disposed, instead of being more noticeable on the odd than the even interstices.

One of the three specimens before me has the derm almost black. The clothing is of the same nature as in the preceding species, but the dark patches are larger and very ill-defined, and there is a large blotch on the base of the prothorax. The elytral setæ are also somewhat longer and more uniformly whitish.

MERIMNETES MONTANUS, n. sp.

Black, antennæ and tarsi more or less diluted with red. Moderately densely clothed with white scales, with numerous very feeble spots of brown. In addition with rather short, semi-decumbent setæ.

Rostrum with three narrow carinæ, almost or quite concealed before abrasion. First joint of funicle subequal in length with second and third combined. *Prothorax* with rather strongly rounded sides; surface vermiculate; with a rather feeble median line. *Elytra* ovate, with regular rows of large, partially-concealed punctures; alternate interstices very feebly raised. Length, 6¼-6½ mm.

Hab.—Tasmania: Summit of Mount Wellington (A. M. Lea).

The length is about equal to that of *uniformis*, and slightly less than that of *australis*, but from both species it

differs in being broader, antennæ somewhat shorter and stouter, eyes more projecting, rostrum stouter, prothorax shorter with more rounded sides, and the clothing somewhat different.

The white scales are not so dense as to conceal the derm, in consequence of which the whole insect has a somewhat greyish appearance. Many of them (especially along the suture) have a golden gloss. The darker elytral spots are nowhere sharply defined or large. The elytral setæ are much less erect than usual; on some specimens most of them are whitish, on others they are mostly dark. The basal segment of the abdomen is more concave in the male than usual.

MERIMNETES VIRIDIS, n. sp.

Black, appendages red. Densely clothed with green or greenish-grey scales, frequently with a golden gloss. In addition with short, semi-decumbent setæ.

Rostrum with a narrowly impressed and usually concealed median line. Antennæ thinner than usual; first joint of funicle slightly but distinctly longer than second and third combined. *Prothorax* granulate-punctate or feebly vermiculate. *Elytra* ovate; with regular rows of large, partially-concealed punctures; interstices regularly convex. Length, 4½-5½ mm.

Hab.—New South Wales: Mount Kosciusko (R. Helms and W. E. Raymond).

In size and structure almost identical with *oblongus*, but the clothing more or less metallic, instead of a dingy, feebly-mottled grey. A specimen from the Victorian Alps was given to me by Mr. Blackburn as *M. uniformis*, Boh. (?). It, however, has both legs and antennæ reddish, and is less than half the size of *Otiorhynchus raucus* (a species with which Boheman compared *uniformis*).

Apparently a common species. The bulk of the scales are green, and frequently with a metallic gloss; many singly-scattered scales are decidedly golden. One specimen has the whole of the scales golden. With most species of the genus the rostrum is carinated, although to see the carinæ it is sometimes necessary to remove the scales; but in the present species the carinæ are entirely absent.

MERIMNETES CELMISIÆ, n. sp.

Black, antennæ (except club and tip of scape) red. Moderately densely clothed with brilliant metallic scales, varying from golden-green to purplish-blue. In addition with very short setæ.

Rostrum non-carinate. First joint of funicle slightly longer than second and third combined. *Prothorax* scarcely granulated, with fairly large, more or less concealed punctures. *Elytra* ovate, with regular rows of large, partially-concealed punctures; interstices regularly rounded. Length, 3⅜-4¼ mm.

Hab.—Victoria: Mounts Buffalo and Baldi; New South Wales: Mount Kosciusko (H. J. Carter).

Readily distinguished from all species known to me by its black and red antennæ, black legs, and beautiful scales. Mr. Carter informs me that on Mount Koscuisko it is found at an elevation of 6,000 ft. on a large white daisy (*Celmisia*, sp.).

MERIMNETES DECIPIENS, n. sp.

Black, appendages reddish. Densely clothed with greyish scales, more or less densely-mottled or spotted with brown. In addition with moderately long, recurved setæ.

Rostrum very indistinctly carinated, even on abrasion. Antennæ rather shorter and stouter than usual in the genus; first joint of funicle somewhat shorter than second and third combined. *Prothorax* about as long as wide in male, gently transverse in female; granulate-punctate, and with a feeble median line; but derm almost entirely concealed. *Elytra* ovate, with regular rows of large punctures, appearing small and narrow through clothing; interstices regularly rounded. Length, 3-4 mm.

Hab.—Tasmania (H. H. D. Griffith), Mount Wellington, Hobart (A. M. Lea).

The smallest of the genus, and in size and appearance remarkably close to *Neomerimnetes destructor*, but the second segment of abdomen longer than third and fourth combined, and its suture with first not straight but curved upwards from each side, so that at the middle it is about one-half longer than it is at the sides.

The clothing is of a rather dingy slaty-grey, sometimes almost uniform, but usually more or less distincly mottled or spotted with brown, especially on the elytra. On an occasional specimen the elytral clothing is mostly pale-brown, with spots of slaty-grey and darker brown.

NEOMERIMNETES (1) INFLATUS, n. sp.

Reddish-brown, appendages reddish. Densely clothed with scales varying from grey to dark-brown. In addition

(1) The species of this genus bear a strong resemblance to those of *Merimnetes*, but may be at once distinguished therefrom by the perfectly straight sutures of the second abdominal segment.

with semi-decumbent setæ, similar in colour to the scales amongst which they are placed.

Rostrum almost parallel-sided to near apex, with a feeble and more or less concealed median carina. Antennæ not very thin; scape almost straight; first joint of funicle stouter and longer than second, second longer but no stouter than third. *Prothorax* moderately transverse, sides evenly rounded; densely granulate-punctate, but sculpture normally concealed. *Scutellum* small, but round and very convex. *Elytra* rather strongly convex, at base no wider than base of prothorax, but sides strongly inflated to about middle, and then strongly diminishing in width to apex; strongly striated, with fairly large but partially-concealed punctures in striæ; interstices evenly rounded. Length (excluding rostrum), $3\frac{1}{4}$-$4\frac{1}{2}$ mm.

Hab.—Queensland: Mount Tambourine, Gympie (H. Hacker).

Larger than *destructor*, the elytra more inflated, scutellum more conspicuous and elytra more variegated.

The male differs from the female in being smaller and narrower, with the elytra less inflated and the legs and antennæ somewhat longer. The derm varies from a rather bright reddish-brown almost to black; the apical segments of the abdomen are sometimes reddish. The club is usually darker than the rest of the antennæ. The clothing is not alike on any two of the five specimens before me. On the type male it is of a dingy-grey, with a large parallel-sided, chocolate-brown patch extending the whole length of the prothorax; similar scales clothe most of the elytra, but with short spots of paler scales. On the type female it is also grey, but somewhat mottled with ochreous, the brown scales are absent from the prothorax, and on the elytra almost confined to a rather wide curved fascia about summit of posterior declivity. The other specimens have the clothing intermediate in character.

MERIMNETES UNIFORMIS, Boh.

This species was described as having the antennæ and legs black. The only species known to me in which both the antennæ and legs are black is one which I have from Mount Victoria and Jenolan. (2) It is, for the genus, a large species, measuring 8 mm. (including the rostrum), a length exceeded by only two species of the genus known to me. Boheman described the species as slightly longer and narrower than *Otiorhynchus raucus*, (3) and with this my specimens agree.

(2) In New South Wales, the type was from New Holland. In Masters' Catalogue it is recorded from Victoria.

(3) Two specimens of *O. raucus* before me measure 7 and $7\frac{1}{2}$ mm. respectively.

M. æqualifrons has sometimes the legs and antennæ black, wholly or in part, but usually some parts are quite distinctly red; that species, however, is much smaller than *O. raucus*.

MERIMNETES ÆQUALIFRONS, Blackb.

This species was described as being without a fine longitudinal impression between the eyes. It, however, is really present, although sometimes concealed by the clothing. The scales are nearly always more or less ashen, but the elytra are occasionally feebly spotted, and the prothorax has sometimes a feeble dark stripe along the middle, and occasionally a very feeble one on each side. The legs and antennæ were not mentioned, being presumably included under the word "piceus." In most of the specimens before me they are more or less black, but occasionally are decidedly reddish, more especially the tibiæ and tarsi. The basal joint of the funicle is about as long as the three following combined.

SUBFAMILY AMYCTERIDES.

ACANTHOLOPHUS EXIMIUS, Macl. *(Cubicorrhynchus)*.

A specimen in the Macleay Museum is labelled as *Cubicorrhynchus eximius*, Macl., and although it is not the type (this should be in the Australian Museum) it agrees with the description, and was probably named from the comparison with the type.(4)

The species is evidently an *Acantholophus*. Its head and prothorax certainly somewhat resemble those of several species of *Cubicorrhynchus*, but so do those of many other species of *Acantholophus (irroratus*, Macl., *denticollis*, Macl., and *planicollis*, Wath., amongst others). The shape of the head is almost exactly as in *irroratus*, except that the conjoined tubercles close to each eye are less prominent, and that the eyes are more prominent. The prothorax has numerous granules (not as numerous as in *denticollis* and *planicollis)* on its disc, interspersed with a few of larger size. There is a small conical tubercle on each side of apex, a less conspicuous one on each side of base, and a larger conjoined pair on each side near apex, but separated from apex by a deep impression.

(4) Dr. Ferguson has kindly compared this specimen with the type, and has written me as follows:—"I took the Macleay Museum specimen of *eximius* down to the Australian Museum and compared it with the types. They are identical in regard to tubercles, granules, etc., the only difference being that the types are slightly wider and fuller in the elytra, and somewhat more convex on ventral segments. These differences are in my opinion sexual, and I should think that the Macleay Museum specimen was the male, and the types females."

The elytra are those of quite a typical *Acantholophus*: the conical tubercles are on the third, fifth, and seventh interstices; those on the third commence on the base and terminate just below summit of posterior declivity, those on the fifth commence at the base and terminate at the declivity, and those on the seventh commence near the shoulder and terminate before the middle.

The Macleay Museum specimen is from Stirling Range (the locality given in Masters' Catalogue), but the type was recorded from King George Sound.

CUBICORRHYNCHUS STERILIS, Pasc.

The description of this species is utterly worthless, being little more than a brief comparison with *morosus*, a name which is probably applied to many different species in collections. In *morosus* and the allied species (*taurus*, *Mussoni*, *dilaticeps*, Blackb.; *piceosetosus*, *maculatus*, *calcaratus*, Macl.; *occultus* and *modestus*, Sloane) I believe it to be impossible to conclusively identify most of the species from the descriptions already published, and, further, that it is almost impossible to describe the females of most of them so that they can be conclusively identified. They all have an oblique, obtuse, granulated ridge on each side of the base of the prothorax, and in the middle of the base itself two granules rather more conspicuous than those elsewhere

Most of the species, however, may be quite readily identified by the tibiæ of the male, and especially the hind pair; and these are not even mentioned in the description of *sterilis*. But as the type should be in the British Museum, some hope may be entertained of having the tibiæ described eventually.(5)

CUBICORRHYNCHUS PICEOSETOSUS, Macl.

The types of this species are both females. Their setæ are darker and shorter (on the apical half of the elytra, however, they are much as in many other species of the genus) than in any other specimens I have seen, and this is possibly characteristic of the species. Structurally I cannot distinguish them from the types of *maculatus*, but possibly an examination of males of both forms would confirm them as distinct.

(5) Mr. C. J. Gahan writes me that the type of this species "is evidently a female; the hind tibiæ are straight, not granulated, covered with pale scales, with setæ interspersed."

CUBICORRHYNCHUS MUSSONI, Blackb., and DILATICEPS, Blackb.

I think it extremely probable that the types of both these species are females. On enquiry from Mr. Blackburn he wrote that there was "nothing remarkable about the hind tibiæ of either of the species you enquire about."

BUBARIS HARDCASTLEI, n. sp.

Black. Rostrum, under surface, and appendages with blackish setæ, becoming very short on upper surface.

Head rough. Rostrum wider than long, separated from head by a deep impression; with four strongly-punctured ridges and three deep grooves, of which the median one is continuous and the others deep and wide at base, but narrow and shallow at apex. Scape stout and curved, strongly inflated at apex; four apical joints of funicle strongly transverse. *Prothorax* moderately transverse, sides strongly rounded; with large, round, clearly-defined granules and small tubercles, differing only in size. *Elytra* comparatively short, base not much narrower than prothorax at its widest, sides dilated to beyond the middle; with rows of very large, irregular punctures, becoming more regular on sides; with rows of granules varying considerably in size; base with four strong projections. *Abdomen* with sparse and comparatively small punctures. Length, 9½-10 mm.

Hab.—Queensland: Cunnamulla (H. Hardcastle).

A very wide species with larger granules than usual and without special tubercles crowning the posterior declivity.

The two specimens before me (and which are probably both females) are practically without clothing other than the setæ; but as in some of the depressed places some very short pubescence can be seen, it is probable that on freshly-matured specimens the clothing would be more distinct. The elytral granules are very variable in size. Those on the second interstice are larger than any of the others, and many could fairly be regarded as small tubercles; the fourth interstice has also some large granules. The suture and posterior declivity are both granulate. The larger elytral granules, instead of being crowned by a single seta on each, are usually supplied with several, and the setæ, instead of being fairly long and suberect, are very short and depressed. Even when there is but one seta (both on prothorax and elytra) that seta arises from a feeble elevation in the middle of a circular depression, crowning the summit of the granule; the depressions are always conspicuous, even on the smallest granules. On each elytron there is a rather strong projection on the

shoulder and on the third interstice, that on the shoulder is more advanced than the other, but is no larger; each projection has numerous granules, and these are so disposed as to be suggestive of the suckers on the arms of an octopus. The suture could hardly be regarded as produced at the base.

MYTHITES FRATER, n. sp.

♂. Black; upper surface with very short, spare black setæ; the depressed spaces with indistinct brownish pubescence. A ridge of black setæ or hair extending from apex of abdomen to between middle coxæ, where it is densest. Legs with black setæ

Head with three deep and wide grooves. Rostrum separated from head by a strong transverse impression, with a deep median channel, each side of base with a short continuation of the lateral groove of head. *Prothorax* about as long as wide; with large, irregular elevations and deep impressions. *Elytra* at base about the width of prothorax, somewhat wider about middle; with irregular rows of large punctures, becoming very large at sides; second interstice with a distinct tubercle just below summit of posterior declivity; third with a carinated ridge on basal third or two-fifths, the ridge projecting on to elytra at base, behind the ridge, with two or three distinct tubercles, of which the apical one is usually close to the one on second interstice; fifth and seventh interstices with some smaller tubercles; shoulders strongly projecting on to prothorax, a laterally-projecting subhumeral tubercle on each side. Front tibiæ inflated at apex. Length (excluding rostrum), 13½-18 mm.

♀. Differs in being larger, elytra wider, apex with two conjoined mucros, third interstice less produced at base; undersurface without the ridge of hair; and front tibiæ simple.

Hab.—New South Wales: Mudgee, Coonabarabran, New England, Clarence River (Macleay Museum).

I have seen in some collections as *Euomus basalis*, Boi., and *Mythites sulcicollis*, Germ.; but the sutural and third interstices not becoming conjoined at the base readily distinguishes from the species I have identified as *basalis*, although at a glance the two species appear to be identical; whilst *sulcicollis* has the prothorax densely granulate, and usually with a single pronounced median channel. From the description of *perfossus* it differs in being considerably larger (the smallest specimen is 6½ instead of 4½ German lines), with the basal joint of the funicle longer than wide (Germar describes the funicle as having all of its joints transverse), as well as in the sculpture of both prothorax and elytra. *Degener* is described as having only a single depressed carina in front.

On the prothorax there is a deep and wide median channel, on each side of which there is a strong ridge, strongly swollen laterally before the middle; on each side of the ridge there is a large irregular depression, interrupted by irregular elevations, of which a few are in the shape of large slightly convex granules or obtuse tubercles. The depression is roughly divided into four arms, of which one becomes very deep and terminates in front at the ridge margining the median channel, a second is continued round the front and sides so as to appear as a very irregular subapical constriction, a third opens feebly out into the median channel near the base, and the fourth is continued shallowly to the base where the projecting shoulder rests in it. But the whole surface of the prothorax seems more or less variable, although the elevations and the depressed spaces are always very pronounced. True isolated granules are nearly always absent. The tubercle on the second interstice sometimes appears almost as if it belonged to the third. On one female the ridge on the third interstice on the right side is continued almost to the posterior declivity.* The tubercles on the seventh, although fairly large, appear to be little more than undulated spaces between the punctures, owing to the large size of these. Each front tibia of the male is inflated at the apex, with the under surface of the inflated portion concave and covered with short, dense, black setæ.

MYTHITES POROPTEROIDES, n. sp.

♀. Black; upper surface not very sparsely clothed with setæ, varying from short to moderately long, and from stramineous to black Under-surface rather sparsely clothed, except for a distinct line of stramineous setæ extending from apex of abdomen to between middle coxæ: legs rather densely clothed.

Head with three deep and wide grooves, of which the median one is deeper but narrower than the others. Rostrum separated from head by a deep transverse impression, with a deep and wide median channel; each side of base with a short and comparatively shallow continuation of the lateral groove of head. *Prothorax* very little wider than long, sides feebly rounded; with a wide but rather shallow median channel, on each side of which is a curved elevation extending from apex to beyond the middle; outside of this is an irregular impression, with numerous large, round, slightly convex granules or small tubercles, occasionally almost conjoined. *Elytra* at base no wider than base of prothorax, but considerably wider before the middle, thence strongly decreasing in width to apex, which is rather acute; with irregular rows of

large punctures, becoming shallow towards sides; with two subconical and almost conjoined subsutural tubercles near apex; suture near base raised and joined on to third interstice; third (exclusive of the base) with two or three tubercles, of which the largest is just before summit of posterior declivity; fifth with a distinct and rather long (but not much elevated) median tubercle, with remnants of others, and a short ridge near base; seventh with some small tubercles; shoulders not projecting on to prothorax. Length, 18 mm.

Hab.—Victoria: Geelong (J. F. Mulder).

Readily distinguished from all other species known to me by the elytra strongly narrowed to apex, with the large sutural tubercles almost conjoined, and much closer to the apex than usual: thus instead of being at or close to the summit of the posterior declivity, they are quite close to the apex itself. The elytra are somewhat suggestive of *Poropterus conifer*. In its rounded shoulders it agrees with the female of *tuberculatus*, but the sutural and third interstices are conjoined at the base, instead of separated as in that species.

The irregular sublateral impression of the prothorax from some directions appears almost semi-circular, and curves round as if to join in with the median channel, but is prevented from doing so by two large granules. On the type (and only specimen I have seen) there are (exclusive of its basal connection with suture) two tubercles on the second interstice on the right side and three on the left; on the seventh there are seven on the right and five on the left. It is probable, however, that both the prothoracic and elytral sculpture is subject to more or less variation. It is probable that the male has strongly projecting shoulders

MYTHITES FOVEIPENNIS, n. sp.

♀. Black; clothed with rather sparse blackish setæ; but with a dense ridge of dark-brown or blackish setæ, extending from apex of abdomen to between middle coxæ.

Head with a deep median groove and two or three deep ones on each side. Rostrum separated from head by a deep transverse impression; with a deep and wide median channel; with a deep groove on each side, commencing at base and running out at about the middle. *Prothorax* slightly wider than long, sides moderately rounded, disc feebly convex; with dense, clearly-defined granules, larger at about one-fourth from apex and one-fourth from base than elsewhere; without a median line. *Elytra* at base not much wider than prothorax, and very little wider elsewhere; apex widely rounded; with double irregular rows of very large punctures or foveæ, becoming regular on sides; third and fifth interstices dis-

tinctly raised, with several tubercles overhanging the posterior declivity, and with four projections at base. Length, 16-19 mm.

♀. Differs in being more convex, elytra wider, apex with two small mucros, tubercles overhanging the posterior declivity smaller, and under-surface with a line pubescence instead of a hairy ridge.

Hab.—New South Wales: Blue Mountains, Blackheath (Macleay Museum).

The elytra could scarcely be regarded as granulate, although in places (especially on the suture and posteriorly) a few almost obsolete ones are present; this alone would distinguish the species from *granulatus*. But the foveate impressions are also different; in this species, although very irregular in shape, they are almost regular in continuity, but in *granulatus* they are much fewer in number, more irregularly disposed, shallower, and usually transversely conjoined. The second interstice has a large tubercle overhanging the posterior declivity, the third has a smaller one, and the fifth a still smaller one; immediately below the tubercles there is a somewhat concave space on each side.

Mythites basalis, Boi.

The original description of this species is very unsatisfactory, but as it contains the expression "elytris . . . basi quasi furcaits," I think it may be correctly applied to a species I have long had named as *Euomus basalis*, Boi. This species occurs at King George Sound, Swan River, and Gun Island in Western Australia, and Port Lincoln in South Australia. It has the sutural interstice of each elytron obliquely joined on to the third at the base, so that it projects triangularly forward much as each shoulder does. In other species of the genus the first and third interstices are parallel at the base.

The species was originally described as an *Amycterus*. In Masters' Catalogue it appears under *Euomus*; but Pascoe referred to it (without explicitly consigning it to the genus, however) as a *Mythites*. I have also seen it as an *Acanthomus* (a generic synonym of *Mythites*).

Dialeptopus echinatus, Lea.

On fresh specimens of this species the elytra are conspicuously marked with three white stripes, meeting at the base and again at the summit of the posterior declivity. The white appears almost like enamel, and is present on the tubercles as well as on the general surface.

DIALEPTOPUS SEPIDIOIDES, Pasc

There are before me six specimens which may belong to this species, as several of them agree well with the original description and figure: but they vary in length from 5½ to 7¼ lines, instead of from 7 to 8. The tubercles vary in number, even sometimes on the different sides of an individual. The outer row on each elytron has from 4 to 6 tubercles: the inner from 5 to 8. The species to which these six specimens belong, whether *sepidioides* or not, may be readily distinguished from all others in my collection by the abdomen and metasternum being very highly polished, with a wide shallow transverse impression near the apex of the apical segment (Pascoe does not mention the abdomen). Two of the specimens have the prothoracic crests more parallel than have the others.

DIALEPTOPUS LONGIPES, Lea.

There are eight specimens before me (from Mount Barker and King George Sound) which probably belong to this species: they differ, however, in having the apical mucros more produced and sharper. The types of *longipes* appear to be females, and of the eight specimens now commented upon three appear to be females and five males. The males differ in being narrower (the greatest width of the elytra is no more than that of the prothorax) with the tubercles larger and more conical. The elytral tubercles vary from almost or quite black to a rather bright-red; one specimen has the legs, apex of elytra, and prothoracic crests also diluted with red.

DIALEPTOPUS PYRIFERUS, n. sp.

Black; with black setæ on head, front of prothorax, and legs; with a thin squamosity on parts of sterna; elsewhere almost or quite glabrous.

Rostrum with a fairly deep median channel, bounded by parallel ridges. *Prothorax* about as long as wide, sides strongly rounded and obtusely serrated, median crests feebly waved and obtusely punctate on their upper surface, diverging hindwards, but not to extreme base, greatest width between them about twice the width of their apices; a subfoveate depression in middle of median channel; a small tubercle on each side, allowing the projecting shoulder to rest between it and a median crest. *Elytra* rather narrow, each with two rows of four tubercles; shoulders strongly projecting and subgranulate; with rows of fairly large punctures along upper surface, becoming larger and more regular on sides; apex with a small, obtuse notch. *Abdomen* with large, sparse, shallow punctures, sometimes very feebly defined:

apical segment in one sex with a shallow median depression, in the other with a small, round, subapical fovea. *Legs* long and thin. Length, 11½-12½ mm.

Hab.—South Australia (Macleay and South Australian Museums).

In general appearance very close to *Lindensis;* but the prothoracic crests practically without granules, a less distance across their apices (the space across the apices in *Lindensis* is greater than in any other species known to me), and decidedly converging towards their bases, so that the space they enclose is more pear-shaped; the sides are also less serrated. The elytra not wide across the shoulders distinguishes from the description of *lugubris*, and the very distinct tubercles from the description of *obsoletus*. One specimen was sent as *macilentus*, but it certainly is not that species, which is described as having seven tubercles inwardly and four outwardly, and with the apex strongly emarginate.

The tubercles are not always as black as the rest of the elytra, but they are not distinctly reddish in any of the specimens under examination. They are rather large and increase in size hindwards, the inner ones being rather larger but more obtuse than the outer ones. On two specimens there are only three on the left outer row. The second row of punctures is not, or scarcely, deflected by the tubercles, but is continued on them, usually but one puncture being on the inner side of a tubercle, but sometimes two or three.

SUBFAMILY HYPERIDES.

Eurychirus Alleni, n. sp.

Dark-reddish-brown, antennæ and legs (wholly or in part) paler. Densely clothed with somewhat small, rounded scales; and with thin scattered setæ.

Head with normally-concealed punctures. Rostrum stout, the length of three basal joints of tarsi; with fairly dense punctures; with a feeble impunctate median carina. Two basal joints of funicle moderately long. *Prothorax* slightly wider than long, base not much wider than apex; with small, dense, normally-concealed punctures. *Elytra* (across shoulders) twice the width of prothorax, not much wider than long, shoulders projecting laterally; a strong conical tubercle on each side of middle, preapical callosities small but distinct; with rows of large but partially-concealed punctures, the rows deflected about tubercles. *Legs* moderately long; hind femora just passing elytra; tibiæ narrowly grooved throughout their lower surface. Length, 7-8½ mm.

Hab.—Queensland: Cairns (E. Allen).

Differs from *bituberculatus* in being smaller, the prothorax smaller with less rounded sides, the elytral tubercles much larger, more acute and less upright, the shoulders more prominent, and the legs considerably shorter, with the hind femora thinner and just passing apex of elytra instead of considerably passing (in their ordinary position the hind femora appear to be too short to reach the apex), and the tarsi less parallel-sided. The thickest part of the hind femora in *bituberculatus* is thicker than the base of the elytral tubercles; in the present species the tubercles are considerably thicker than the femora. There are nine specimens before me, and they all differ in these respects from six of *bituberculatus*.

The scales are usually of a golden-brown or bright-fawn colour. On some specimens many of them are brightly golden, or even with a beautiful rose or purplish gloss, especially on the under surface and legs. On the prothorax there is usually a short dark stripe on each side at the base, and remnants of another at each side of apex; but the stripes would not meet if continued to base and apex. On the median segments of the abdomen also the clothing is variegated with black. On one specimen the clothing on the prothorax (except for the short dark stripes) and elytra is of a rather dingy pale-green.

SUBFAMILY APIONIDES.

Apion

In describing species of this genus previously I was under the impression that (in such species where there was a difference) the rostrum of the male was longer than that of the female. I now believe that the reverse is the case. If I am correct in this surmise the following of my previous descriptions will need correction:—

Condensatum.
Æmulum.
Philanthum.
Fuscosuturale.
Integricolle.
Carpophagum.
Immundum.
Solani.
Anthidium.

It will also be necessary to correct in the table *comosum*, Pasc., and *pulicare*, Pasc.

In the descriptions that follow where one sex has the rostrum longer than the other I have assumed that sex to be the female.

APION AGONIS, Lea.

The elytra of most specimens of this species have a very faint greenish gloss.

APION AMABILE, Lea.

The types of this species have the antennæ of a rather dark-reddish-brown.

APION ÆMULUM, Lea.

Four specimens from Chillagoe (Queensland) appear to belong to this species, but they differ from the type (which appears to be somewhat abraded) in having the clothing more uniformly covering the surface, so that the prothoracic punctures are normally quite concealed and the elytral punctures almost so. In the type the club is black and the rest of the antennæ of a rather dark-red. In the Chillagoe specimens the club is also black, but the other joints of the antennæ are reddish-flavous.

APION INORNATUM, n. sp.

Black, shining, glabrous.

Head with two shallow grooves between eyes. Rostrum moderately curved, about once and one-half the length of prothorax; very feebly and gradually decreasing in width; with sparse indistinct punctures. Antennæ inserted about two-fifths from base of rostrum. *Prothorax* about once and one-fourth as wide as long, sides rather suddenly constricted close to apex and then oblique to base, base much wider than apex; with small and rather numerous shallow punctures, causing the derm to appear slightly granulated. *Elytra* subcordate, about one-fourth wider than long; distinctly striated, with rather shallow punctures in the striæ; interstices feebly convex. Length, $2\frac{1}{3}$ mm.(6)

Hab.—New South Wales: Macleay River (R. Helms).

A short robust species, in build resembling *agonis* (with which it would be placed in the table previously given by me), but with the prothorax decidedly narrowed just behind apex, and the rostrum with much finer punctures.

APION TENUISTRIATUM, n. sp.

Black, shining, glabrous.

Head with a shallow but distinct depression between eyes; behind depression with distinct punctures, absent from rest of head. Rostrum almost straight, wide and almost parallel-sided, slightly longer than prothorax; with small and

(6) In previous descriptions of species of *Apion* I included the rostrum in each length given, but in this and all the following species the length is exclusive of the rostrum.

fairly numerous punctures. Antennæ inserted almost in exact middle of sides of rostrum. *Prothorax* distinctly longer than wide, base scarcely wider than apex, sides at apical third constricted, then bulged out and again constricted at basal third; with small and rather sparse but clearly-defined punctures. *Elytra* almost twice as long as their greatest width; very narrowly but distinctly striate, sutural stria with indistinct punctures, second and third without any, fourth with a few small ones, the others with more or less distinct ones except at base and apex. Length, 3⅓ mm.

Hab.—New South Wales (Macleay Museum): Mount Irvine (E. W. Ferguson), National Park (A. M. Lea).

The head is impressed between the eyes with a rather feeble carina on each side, but not one in the middle. This feature will associate it with *pudicum* and *agonis*, rather than with *terræ-reginæ* and *argutulum*. The absence of pubescence will distinguish it from *pudicum*; the shape of the prothorax and the parallel-sided rostrum from *agonis*. At first sight it is strikingly like *Myrmacicelus formicarius* of the *Cylades*.

APION LONGICOLLE, n. sp.

Black, shining, base of funicle dull-red; glabrous.

Head with a few small punctures margining eyes. Rostrum very feebly curved, slightly longer than prothorax, basal third half the width of head across eyes, then strongly narrowed to middle, and then parallel-sided to apex; basal third with small but fairly distinct punctures. Antennæ inserted one-third from base of rostrum. *Prothorax* distinctly longer than wide; base slightly wider than apex, sides gently increasing in width from apex, then rather suddenly but not strongly inflated, and then decreasing in width almost to base, with a slight projection near base; with very minute punctures scattered about, but some larger ones on the sides near base. *Elytra* fully twice as long as wide; very narrowly striated, fourth stria with a few indistinct punctures about middle, fifth to ninth with more distinct punctures, but also only about middle. Length, 3¼ mm.

Hab.—New South Wales: Wollongong (A. M. Lea).

In my table would be associated with *agonis*, from which it differs in being larger, prothorax and elytra of different shape, and some of the striæ absent just behind the shoulders. From *tenuistriatum* it differs in the prothorax not so suddenly bulged out, and the subapical constriction absent, the rostrum subulate, and the elytra less suddenly elevated above the prothorax.

The head from some directions appears to be perfectly flat between the eyes, but from other directions a very shallow

impression can be traced there. From above there appears to be a feeble granule on each side of the prothorax near the base, but from the side this is seen to be due to a rather deep impression.

APION CONVEXIPENNE, n. sp.

Black, somewhat shining.

Head with two almost imperceptible grooves between eyes. Rostrum about once and one-half the length of prothorax, rather thin, moderately curved, very feebly decreasing in width from base to apex; punctures very indistinct. Antennæ inserted about two-fifths from base of rostrum. *Prothorax* slightly wider than long, base much wider than apex, sides rather suddenly constricted near apex, and thence oblique to base; with small punctures fairly numerous in some places. *Elytra* strongly convex, subcordate, about once and one-half as long as greatest width; narrowly striated, with small punctures in striæ, the interstices very finely transversely or obliquely strigose or wrinkled. Length, 3¼ mm.

Hab.—Queensland: Cairns (E. Allen), Townsville (W. W. Froggatt).

In my table would be placed with *argutulum*, from which it differs in being considerably larger, the prothoracic punctures finer, the elytral striæ much finer, and the prothorax and elytra of different shape. In appearance it strongly resembles *terræ-reginæ*, but the elytra are apparently glabrous. The prothorax not bulged out in middle readily distinguishes it from *tenuistriatum*.

On close examination an extremely short and sparse pubescence can be traced, but it is so very indistinct (from most directions it is quite invisible under a Coddington lens) that the species could quite reasonably be regarded as glabrous. There is a short, deep, curved, subapical impression on each side of prothorax. The punctures towards sides of elytra appear (from certain directions) to be transversely impressed on the interstices, so that these look almost as if stitched together.

APION NIVEODISPERSUM, n. sp.

Black, somewhat shining, antennæ dull-red, front tibiæ feebly or not at all diluted with red. With snowy pubescence, rather dense on sides of prothorax, sterna, about scutellum and apex of elytra; sparser but more regular on abdomen, legs, head, and base of rostrum, and absent elsewhere.

Head with two shallow grooves between eyes; with rather

numerous but sometimes concealed punctures. Rostrum of male the length of prothorax, of female distinctly longer, feebly curved, feebly decreasing in width from base to apex: basal third of male with fairly distinct punctures, basal fourth only in female. Antennæ inserted about one-third from base of rostrum. *Prothorax* moderately transverse, sides obliquely increasing in width from apex to base; with numerous rather small punctures. *Elytra* subcordate, about twice as long as width at base; distinctly striated, punctures in striæ distinct and fairly regular. Length, 2 mm.

Hab.—Queensland (Taylor Bros.), Chillagoe (H Hacker).

In my table would be placed with *pudicum*, from which it differs in the uneven distribution of its clothing and by the very different shape of the elytra. In *pudicum* these are widest distinctly behind the middle; in the present species they are widest before the middle.

The snowy clothing appears to be readily abraded, especially on the upper surface.

APION SUBOPACUM, n. sp.

Black subopaque, some parts sometimes dull-red. Rather sparsely but almost regularly clothed with white pubescence, except that it is denser on side pieces of mesosternum and usually about scutellum than elsewhere.

Head very shallowly impressed between eyes. Rostrum moderately thin, rather lightly curved, in male about once and one-fourth the length of prothorax, in female once and one-half, with distinct punctures in regular series on the sides, smaller and sparser elsewhere. Antennæ inserted about one-fourth from base of rostrum. *Prothorax* moderately transverse, sides moderately rounded; with numerous rather distinct punctures; with a rather shallow, sub-basal foveate impression. *Elytra* about once and one-half as long as wide; strongly striated, punctures in striæ suboblong; interstices about as wide as striæ, with small dense punctures. Length, 1½-2 mm.

Hab.—Queensland (Taylor Bros.), Chillagoe (H. Hacker), Cairns.

The head appears to have two feeble grooves between the eyes, but they are sometimes so feeble that they would best, perhaps, be regarded as absent. But whether the species is regarded as associated with *terræ-reginæ* or *pudicum*, it is abundantly distinct from either, and in fact from all described Australian species with black legs, by its strong elytral striation, with strong punctures in the striæ.

A few of the specimens before me have the legs, antennæ, and part of the rostrum (sometimes even the prothorax

and elytra) obscurely diluted with red, and there is generally at least a trace of red in the antennæ, but most specimens have the legs and rostrum deep black

APION STILBUM, n. sp.

Black, shining, glabrous.

Head very shallowly impressed between eyes. Rostrum almost straight, about once and one-fourth the length of prothorax, basal fourth fairly wide, then strongly narrowed, with the apical two-thirds thin and parallel-sided; punctures very indistinct. Antennæ inserted at basal fourth of rostrum. *Prothorax* about as long as wide, sides gently increasing in width from apex to beyond the middle, and then decreasing to base; with very minute punctures *Elytra* strongly convex, about twice as long as wide, finely striated, striæ without punctures except about middle third of the fifth to ninth; interstices not separately convex, with extremely minute punctures. Length, 1⅔-2 mm.

Hab.—New South Wales: Illawarra (H. J. Carter), Otford (A. M. Lea).

The rostrum at about the basal two-fifths is suddenly narrowed, and then parallel-sided to apex, so that it has a very unusual appearance The head is decidedly impressed between the eyes, but the impression is single, so that in my table it would be associated with *agonis*, which has the rostrum regularly decreasing in width and with strong punctures; *agonis* is also a larger species, with wider elytra, on which the striæ are considerably stronger.

APION PILISTRIATUM, n. sp.

Black; legs (claws excepted) and antennæ flavous; rostrum of male (except basal fourth) also flavous, but of female black. Moderately densely clothed (more densely on sterna than elsewhere) with short white pubescence, on the elytra formed into distinct lines.

Head with derm partially concealed. Rostrum lightly curved, in male the length of prothorax, in female slightly longer; basal fourth in male with partially-concealed punctures; elsewhere and the whole rostrum of female with very small but fairly distinct punctures. Antennæ inserted at basal fourth of rostrum. *Prothorax* moderately transverse, sides lightly constricted near base and apex, and rounded in middle, base much wider than apex; with dense and rather strong punctures; with a small but rather deep sub-basal fovea *Elytra* about once and one-half as long as wide;

strongly striate-punctate; interstices about as wide as striæ. Length, $1\frac{1}{5}$-$1\frac{1}{3}$ mm.

Hab.—Queensland: Mulgrave River (H. Hacker).

In my table the female would be placed with *amabile*, from which it differs in its much smaller size, more compact form, and sparser and more regular clothing; the males would be placed with *condensatum* and *æmulum*, which are also larger and have very different elytral clothing. In build it is like small specimens of *subopacum*, but the legs are pale.

The legs are very sparsely clothed, the rostrum is glabrous except at the base. On the elytra the pubescence is almost confined to a distinct line on each interstice. The interstices are about the same width as the striæ, but at the first glance their clothing causes them to appear much narrower.

APION CONGESTUM, n. sp.

Black, or with parts dark-reddish-brown; legs mostly flavous, rostrum and antennæ variable. Rather densely clothed (more densely on under than upper surface) with white or whitish pubescence, but somewhat variegated on elytra.

Head with fairly numerous but partially-concealed punctures. Rostrum lightly curved; in male fairly stout, very little longer than prothorax and with numerous but mostly partly-concealed punctures; in female longer and thinner than in male, with sparser and smaller punctures, concealed only towards base. Antennæ inserted at basal fourth of rostrum in male, slightly nearer the base in female. *Prothorax* moderately transverse, sides lightly constricted near base and apex, and rounded in middle, base about once and one-half the width of apex; with fairly dense and rather strong punctures; sub-basal fovea rather shallow. *Elytra* about twice as long as wide; strongly striate-punctate; interstices wider than striæ, with numerous small punctures. Length, 2-$2\frac{1}{3}$ mm.

Hab.—Queensland: Chillagoe, Kuranda, Cairns (H. Hacker), Port Denison (Macleay Museum).

One of the specimens before me could fairly be regarded as having the body (including the rostrum) black. This would render its position in my table (depending greatly on colour) uncertain. But comparing it with *amabile* it differs in the rostrum being shorter and more noticeably curved, and in its black tarsi. *Condensatum* is a smaller species with a slightly shorter rostrum and variegated elytral clothing. *Æmulum* has the rostrum almost straight. *Philanthum* is a smaller species with the tarsi not entirely dark, rostrum straighter, etc. *Fuscosuturale* is a smaller species, with longer rostrum and paler tarsi, etc.

One male has the body black with the apical half (but not tip) of rostrum and the legs (the tarsi excepted) flavous, but with the knees and tip of tibiæ infuscated, and its antennæ (including the club) flavous-red. Two other males have the elytra dark-reddish-brown, except the base apex and suture (the two colours obscurely limited) and the apical half of rostrum and the antennæ of a similar brown; two females have the knees much darker than in the males, with the rostrum and antennæ very obscurely diluted with red in parts. The clothing appears to be easily abraded, at least on the upper surface. On the elytra it is usually transversely infuscated (to about the fourth interstice on each) about the middle, the infuscate patch sometimes feebly extending towards the base. The rostrum of the male is sparsely clothed almost to the apex, but in the female it is clothed only towards the base.

APION VERTEBRALE, n. sp.

Of a rather bright-reddish-brown; scutellum, suture, under surface, head and parts of rostrum black, legs flavous but in parts infuscate. Moderately densely clothed with stramineous pubescence, paler and denser on under than upper surface.

Head with dense more or less concealed punctures. Rostrum very lightly curved; in male fairly stout, very little longer than prothorax and feebly decreasing in width from base to apex; with moderately dense punctures, more or less concealed on basal half; in female thinner and considerably longer and with smaller but less concealed punctures. Antennæ inserted at about one-third from base of rostrum. *Prothorax* and *elytra* much as in the preceding species, except that the prothorax is longer and with smaller punctures, and that the elytral interstices are more convex and wider. Length, 2¼-2½ mm.

Hab.—New South Wales: Ourimbah (Macleay Museum and E. W. Ferguson), Gosford (H. J. Carter).

In build and clothing much like *amabile*, but prothorax and elytra pale. In build close to *congestum*, from which it is distinguished by the different colour of prothorax and the tarsi not entirely dark. In my table it would be associated with *foveicolle*, *teretirostre*, and *fuscosuturale*, all of which are much smaller and from Western Australia.

The margins of the elytra, except at the tip, are usually blackish, the coxæ trochanters and claws are black or blackish, with the tips of the tarsal joints and sometimes the knees and tips of tibiæ infuscate; sometimes also the femora are feebly infuscated in the middle. The rostrum of the male

has its tip and basal two-fifths almost black, the balance being of a rather bright-red (as also are the antennæ); in the female the paler portions are of an obscure reddish-brown, with the antennæ almost the same On the elytra there is generally a transverse glabrous patch about the middle, extending across three interstices on each, but usually interrupted at suture; on some specimens the patch is quite sharply limited, but on others it is less distinct. On the male rather more than half of the rostrum is clothed; on the female the clothing is confined to the basal third.

APION MICROSCOPICUM, n. sp.

Flavous, parts of under surface and tip of rostrum somewhat darker, claws black. Moderately densely clothed with white pubescence, denser on sides of meso- and meta-sternum than elsewhere

Head with concealed punctures Rostrum lightly curved, about the length of prothorax in male, slightly longer in female; with small and fairly numerous punctures. Antennæ inserted at about basal third of rostrum. *Prothorax* moderately transverse, sides lightly increasing in width from apex to near base; with fairly numerous but more or less concealed punctures; with a small and frequently-concealed subbasal fovea. *Elytra* about twice as long as wide; strongly striate-punctate; interstices slightly wider than striæ. Length, 1-1⅓ mm

Hab.—Tasmania: Hobart, Huon River, Frankford, Mount Wellington, Swansea, Mole Creek (A M. Lea); Victoria: Emerald (H. H. D. Griffith).

The smallest species yet recorded from Australia; there is, however, a still smaller species (represented by a single abraded specimen) from North-Western Australia in the Macleay Museum.

The legs are generally paler than the other parts.

APION TASMANICUM, n. sp.

Of a rather bright-reddish-brown, legs somewhat paler; base and tip of rostrum, scutellum, suture, sterna, claws, and club black; tarsal joints mostly tipped with dark-brown, knees sometimes lightly infuscated. Moderately densely clothed with white or whitish pubescence, paler on under than upper surface, and denser on sides of meso- and metasternum than elsewhere.

Head with dense but normally-concealed punctures. Rostrum moderately curved, rather thin (thinner in female than in male), about once and one-fourth the length of prothorax in male, once and one-third in female; with small

and fairly numerous punctures, concealed only at base in male. Antennæ inserted about one-third from base of rostrum. *Prothorax* about once and one-half as wide as long, sides lightly constricted near base and apex, and rounded in middle, with fairly numerous and rather strong but partially concealed punctures; sub-basal fovea shallow and usually concealed *Elytra* not twice as long as wide; strongly striate-punctate, interstices much wider than striæ. Length, 1½-2 mm.

Hab.—Tasmania (Macleay Museum): Huon River, Frankford, Hobart (A. M. Lea).

On abrasion there is seen to be a slight impression at the base of the prothorax, but it could not be fairly called a fovea; but regarding it as such the species would be placed with *foveicolle* and *fuscosuturale*. From the former it is distinguished by its decidedly curved rostrum, and from the latter (to which in general appearance it is very close) by its black sterna. Regarding the prothorax as non-foveate, it should be placed with *integricolle* and *carpophagum*, both of which are considerably larger with paler legs, etc. From the South Australian *turbidum* it differs in being larger, with the rostrum more curved.

The colours are somewhat similar to those of *vertebrale*, but the legs are darker, and the size is much smaller Sometimes the elytral margins are narrowly stained with black. There is a small glabrous or semi-glabrous spot on each elytron, on the second, third, and fourth interstices about the middle, and (probably owing to partial abrasion) the two frequently appear to be partially or quite conjoined. The rostrum is clothed only at the base.

APION NIGROSUTURALE, n sp.

Dark-brown; scutellum, suture, and margins of elytra and under surface (abdomen excepted or not) black; legs flavous, tarsi infuscate and claws black; antennæ dull-red, club darker; rostrum with the part between tip and basal third (which are black or blackish) somewhat flavous in male, much darker in female. Moderately clothed with whitish pubescence on upper-surface, and feebly variegated on elytra; on lower-surface with denser and snowy clothing; rostrum clothed almost to apex in male, at basal half only in female.

Head with dense partially-concealed punctures. Rostrum of male moderately stout, lightly curved, about the length of prothorax, with rather numerous but mostly concealed punctures; of female longer, thinner, and more curved, and with smaller but less concealed punctures. Antennæ inserted

at about one-fifth from base of rostrum. *Prothorax* and *elytra* as described in the preceding species. Length, $1\frac{2}{3}$-2 mm.

Hab.—North-Western Australia (Macleay Museum): Wyndham (R. Helms).

In general appearance close to the preceding species, but smaller, darker, the rostrum (especially in the male) less curved, and the clothing denser and more variegated. Regarding it as (in my table) associated with *philanthum*, it differs in being smaller, paler, with the rostrum more curved and the disproportion between the sexes less pronounced, although still quite noticeable. If not associated with *philanthum* it would be with *integricolle* and *carpophagum*, each of which is a larger species, with the male rostrum stouter, etc. In length it is much the same as the South Australian *turbidum*, but it is wider, with slightly more curved rostrum and paler legs.

On the elytra there is a feeble transverse infuscate patch of pubescence about the middle, and immediately behind (and usually before) the patch the clothing is paler and denser than usual, so that the darker patch, although not very dark, usually appears to be quite conspicuous.

SUBFAMILY RHINOMACERIDES.

Auletes.

In this genus the rostrum of the male is usually shorter than that of the female.

In the table of the genus given in Proc. Linn. Soc., New South Wales, 1898, p. 626, the fourth line "Colour entirely dark" should have been followed by a line "Colour not entirely dark."

Auletes melanocephalus, Er.

This is probably one of the forms of *suturalis*, in which case, as the older name, it will take precedence. I have specimens of *suturalis* having the rostrum entirely dark, and others having it dark only at the base. But in all of them the suture is more or less distinctly infuscated; a character not mentioned by Erichson, so that the two names may really belong to distinct species.

Auletes filirostris, Pasc.

A specimen from the Swan River probably belongs to this species, but the club of its antennæ is infuscated only instead of black, and in addition to its whitish pubescence these are scattered about darker and semi-erect setæ. Its

rostrum is rather more than twice the length of the prothorax instead of "nearly twice as long," but this may be due to its being a female and the type a male.

AULETES NIGRITARSIS, Pasc.

I have seen no specimens that agree exactly with the description of this species; *aterrimus* and *imitator* have the legs entirely black. The dark varieties of *inconstans* have the hind femora and tibiæ partly dark and the rostrum straight

AULETES MINOR, Lea.

Since the type of this species was described I have seen numerous other specimens (from Ourimbah and Gosford), and most of these are entirely black, or with a very faint purplish gloss on the elytra.

AULETES MELALEUCÆ, Lea.

I was in error in recording this species from Tasmania. There is a very closely-allied species, which caused me to make the mistake; it is described below as *decipiens.*

AULETES PUNCTIPENNIS, n. sp.

Flavous or reddish-flavous; tip of rostrum, club, and claw-joints more or less black. Moderately densely clothed with white pubescence.

Head with dense punctures. Rostrum almost straight, about once and one-fourth the length of prothorax, sides feebly incurved to middle; with a row of feeble punctures on each side. Antennæ inserted about one-fourth from base of rostrum, second joint longer than first and third. *Prothorax* not much wider than long, sides moderately rounded in middle, base very little wider than apex; with dense and rather small punctures. *Elytra* comparatively long, parallel-sided to near apex; with numerous and comparatively regular rows of punctures, rather larger than on prothorax, and almost as distinct at sides and apex as elsewhere. Length (excluding rostrum), 2½-3 mm.

Hab.—Tasmania: Frankford, Bruni Island (A. M. Lea); Victoria: Bullarook Forest (C. French); New South Wales: Illawarra (George Compere).

The club is sometimes infuscate only, whilst occasionally its basal joint is scarcely paler than the rest of the antennæ. Two specimens are feebly infuscated between the eyes. The pubescence on some specimens is almost of a snowy whiteness, but it is liable to abrasion. In general appearance close to the species I have identified as *filirostris,* but the second joint

of antennæ longer than the first and third, instead of shorter.

A specimen from the Huon River is rather small, of a brighter colour, with paler club and sparser clothing; but its antennæ are as in normal specimens.

AULETES PUNCTICOLLIS, n. sp.

Reddish-flavous; metasternum, club, and two apical joints of tarsi black, rostrum becoming darker from base to apex but nowhere quite black. Moderately clothed with short whitish pubescence, and with a few scattered semi-erect setæ.

Head with dense punctures. Rostrum very feebly curved, about once and one-third the length of prothorax, sides feebly incurved to middle, with a row of feeble punctures on each side. Antennæ inserted close to base of rostrum, second joint the length of first, and stouter but slightly shorter than third. *Prothorax* not much wider than long, sides moderately rounded, base and apex subequal in width; with dense and comparatively coarse punctures. *Elytra* parallel-sided to near apex; with fairly distinct but small punctures near base (much smaller than on prothorax), and small and indistinct ones elsewhere Length, 2 mm.

Hab.—Western Australia: Vasse (A. M. Lea).

The prothorax is of a brighter red than in *melaleucæ*, and with sparser pubescence and sparser and larger punctures. The rostrum is longer than in *pallipes*, and the tarsi are differently coloured. On each of the two specimens before me there is a feeble infuscated spot between the eyes.

AULETES BRYOPHAGUS, n. sp.

Obscurely flavous; tips of claw-joints black, apical joint of antennæ infuscate. Clothed with rather long whitish pubescence, and with fairly numerous semi-erect setæ.

Head with fairly numerous but partially-concealed punctures. Rostrum almost straight, no longer than prothorax, with a row of punctures on each side. Antennæ inserted close to base of rostrum, second joint the length of first but shorter than third. *Prothorax* about as long as wide, sides feebly rounded, base and apex subequal; with fairly dense but partially-concealed punctures. *Elytra* parallel-sided to near apex; with dense punctures, small but fairly distinct at base, and smaller elsewhere, but all partially concealed. Length, $1\frac{3}{4}$ mm.

Hab.—Tasmania: Hobart (A. M. Lea).

Smaller and hairier than *punctipennis*, and the rostrum shorter; from *pilosus* it differs in being paler, with longer

antennæ and considerably finer punctures, both of prothorax and elytra. On the elytra the pubescence appears to be denser on some parts than on others, but this may be due to partial abrasion. The unique specimen described was taken in moss.

AULETES SOBRINUS, n. sp.

Black; elytra, rostrum, antennæ (basal joint and club excepted), legs (tarsi excepted), and parts of under surface of a rather dark-brown. Moderately clothed with not very short white pubescence, and with a few scattered semi-erect setæ.

Head with rather dense punctures. Rostrum lightly but distinctly curved, about once and one-fourth the length of prothorax, sides very feebly incurved to middle; with a row of punctures on each side. Antennæ inserted near base of rostrum, second joint slightly longer than first, and stouter than but equal in length with third. *Prothorax* moderately transverse, sides strongly rounded, base not much wider than apex; with moderately dense punctures. *Elytra* feebly dilated to beyond the middle; punctures at base as large as on prothorax, but smaller elsewhere. Length, 2 mm.

Hab.—South Australia

The hairy and black prothorax will distinguish from all species except *variipennis*, which has a shorter rostrum and is otherwise different; in some respects it is fairly close to *densus*. In some lights the elytra of the type have a faint purplish gloss. The prothoracic punctures are about the size of those on *suturalis*, but not quite so dense. The elytral punctures are in feeble rows, but the linear arrangement is distinct only near the base.

AULETES ATERRIMUS, n. sp.

Deep black, middle of antennæ sometimes obscurely diluted with red. Clothed with dark subsetose pubescence.

Head with fairly dense punctures. Rostrum thin, distinctly curved, the length of head and prothorax combined, apex slightly inflated; with a row of feeble punctures on each side. Antennæ inserted at extreme base of rostrum, second joint subequal in length with first but slightly shorter than third. *Prothorax* moderately transverse, sides strongly rounded, base distinctly wider than apex; with dense, clearly-defined punctures. *Elytra* dilated posteriorly; with small punctures, nowhere sharply defined and all smaller than on prothorax. Length, 1⅗-2 mm.

Hab.—New South Wales: Sydney (H. J. Carter and A. M. Lea).

Considerably larger and more robust than *minor*, and with a longer and curved rostrum. The pubescence, although fairly dense, appears (except from certain directions) very sparse on account of its colour.

A specimen from Cairns probably belongs to this species but is larger ($2\frac{1}{4}$ mm.), rather more robust, and with somewhat more distinct elytral punctures.

AULETES IMITATOR, n. sp.

Deep black; middle of antennæ, or sometimes the second joint only, more or less diluted with red. Pubescence much as in the preceding species.

Head with not very dense punctures. Rostrum almost straight, in male the length of prothorax, in female slightly longer; with a row of distinct punctures on each side. Antennæ inserted near base of rostrum, second joint slightly shorter than first and distinctly shorter than third. *Prothorax* much as in the preceding species, but with rather larger punctures. *Elytra* with small, fairly dense, and clearly-defined punctures. Length, $1\frac{3}{4}$-2 mm.

Hab.—Tasmania (Aug. Simson): Hobart, Mount Wellington, Huon River (A. M. Lea): South Australia (Macleay Museum).

In general appearance very close to the preceding species, but less robust, rostrum shorter, stouter, and straighter; with the antennæ not inserted at extreme base and the punctures of prothorax larger, and those of elytra more clearly defined; even the smaller ones on the elytra are quite clearly cut.

AULETES INCONSTANS, n. sp.

Black; funicle varying from flavous at base to infuscate at apex; elytra variable in colour; legs reddish flavous, two apical joints of tarsi black. Moderately clothed with short, greyish pubescence.

Head with rather small and not very dense but clearly-defined punctures. Rostrum fairly stout, straight; in male the length of prothorax, in female somewhat longer; with a row of punctures on each side. Antennæ inserted near base of rostrum; second joint slightly shorter than first, and distinctly shorter than third. *Prothorax* moderately transverse, sides strongly rounded, base and apex almost equal; with dense, clearly-defined punctures. *Elytra* parallel-sided to near apex; punctures at base rather smaller than on prothorax, becoming much smaller at sides and posteriorly. Length, $1\frac{3}{4}$-$2\frac{1}{2}$ mm.

Hab.—Tasmania: Mount Wellington (including summit), Hobart, Huon River (A. M. Lea).

A variable species close to *suturalis*, but prothorax always entirely black. The elytra are generally of a bright reddish-castaneous, with the suture and a fairly large space about the scutellum black, and the basal half of the sides infuscate; in several specimens the suture is very narrowly infuscate throughout, the rest of the elytra being very brightly coloured; on another there is a wide feeble infuscate fascia just beyond the middle; occasionally the paler parts of the elytra are of an obscure flavous, whilst occasionally they are scarcely paler than the suture; and sometimes they have a decided purplish gloss.

One male (taken *in cop.* with a quite normal female) has the elytra entirely dark, and the legs dark except that the bases of the femora, the front tibiæ, and bases of the others are of a rather dingy-brown. Another male agrees with this except that its legs (except parts of the tarsi and of the hind tibiæ) are entirely flavous.

AULETES SUBCALCEATUS, n. sp.

Black; elytra of a dingy testaceous, suture darker; funicle of a dingy testaceous, the scape and club somewhat darker; legs obscurely testaceous, in parts black or infuscate. Sparsely clothed with greyish pubescence, and with a few semi-erect setæ scattered about.

Head with moderately dense punctures. Rostrum straight; in male the length of prothorax, in female distinctly longer; feebly dilated from near base to apex; with a row of punctures on each side. Antennæ inserted about one-fourth from base of rostrum, two basal joints stout, subequal in length and each shorter than third. *Prothorax* distinctly transverse, sides moderately rounded, base and apex equal; with dense and moderately coarse punctures. *Elytra* parallel-sided to beyond the middle; punctures at base rather larger than on prothorax, becoming smaller elsewhere but everywhere distinct. Length, 1¾-2 mm.

Hab.—Tasmania: Frankford, Hobart (A. M. Lea).

A small dingy species, in general appearance like a very small *calceatus*, and with a very feeble fringe of whitish pubescence behind the scutellum; but darker and with coarser punctures. In one specimen the prothorax is black but paler at base and apex, in the others it is of a dingy reddish-brown, but also slightly paler at base and apex. The elytral punctures are all clearly defined, and many of them appear to be in feeble rows.

AULETES VARIICOLLIS, n. sp.

Black; base and apex of prothorax, elytra (except suture), funicle, and legs (two apical joints of tarsi black, and femora infuscate in parts), more or less reddish. Moderately clothed with short, greyish pubescence.

Head with moderately dense punctures. Rostrum almost straight; in male about once and one-fourth the length of prothorax, in female about once and one-half; sides feebly incurved to middle; with a row of small punctures on each side. Antennæ inserted near base of rostrum; second joint shorter than first and much shorter than third. *Prothorax* distinctly transverse, sides strongly rounded, base and apex equal; with dense and fairly large punctures. *Elytra* elongate, parallel-sided to beyond the middle; with dense punctures, at base about the size of those on prothorax, becoming smaller at sides and posteriorly. Length, $2\frac{1}{2}$-$2\frac{3}{4}$ mm.

Hab.—Tasmania: Mount Wellington, Stonor (A. M. Lea).

Another variable species. Of five specimens before me but two agree with the above description of colour, a third has the elytra of a rather dingy-brown and the dark parts of the femora black, a fourth has the dark parts of the prothorax reduced to a rounded spot on each side whilst its femora are entirely pale, and a fifth has the prothorax as well as the femora entirely pale. The elytral punctures are very dense, without a trace of linear arrangement, and even the smaller ones are clearly defined. In general appearance it is something like *calceatus* and *densus*, but the punctures are smaller and denser.

Another specimen (from Bruni Island) possibly belongs to this species, but is entirely pale, except that the tip and sides of rostrum and claw-joints are infuscated; but as the punctures between its eyes are much sparser than in the other specimens it may represent a distinct species.

AULETES DECIPIENS, n. sp.

Flavous; head, rostrum, club, a wide prothoracic fascia, scutellum, suture, metasternum, and two apical joints of tarsi, black or blackish. Moderately clothed with rather short, greyish pubescence.

Head with moderately dense punctures. Rostrum straight; in male the length of prothorax, in female distinctly longer; sides feebly incurved to middle, with a row of punctures on each side. Antennæ inserted almost at extreme base of rostrum; second joint stouter but no longer than first,

and shorter than third. *Prothorax* moderately transverse, sides lightly rounded, base and apex equal; densely and rather coarsely punctured. *Elytra* feebly dilated posteriorly, with a few coarse punctures near base, elsewhere much smaller and somewhat rugose. Length, 2 mm.

Hab. Tasmania: Hobart, Huon River, Frankford (A. M. Lea).

The abdomen is usually black, but sometimes dark-brown, the hind femora (and sometimes the middle ones as well) are infuscated in the middle, the sides of the elytra are usually infuscated towards the base. The prothoracic fascia in one specimen occupies more than half of the surface, and is more distant from the apex than the base, in two others it occupies less than half the surface, whilst in another it occupies almost the entire surface, but is paler and not so sharply defined; in another it is absent except for a feeble spot on each side of the base; another specimen agrees with this but has the abdomen entirely pale, whilst still another has both prothorax and abdomen entirely pale. The elytral punctures appear to have a faint linear arrangement.

In general appearance close to *melaleucæ*, but rostrum much shorter, elytra with much more distinct punctures and prothorax with sparser and larger punctures.

SUBFAMILY HAPLONYCIDES.

Haplonyx scolopax, Pasc.

It is probable that the description of this species was drawn up from a partially-abraded specimen of *Spencei*. Mr. Masters has sent me for examination a Queensland specimen labelled *scolopax* (it was quite probably from Mr. Masters that the type was received), which agrees with Pascoe's description, and which is certainly *Spencei*. I have also other specimens of *Spencei* from New South Wales, Victoria, and Tasmania, and ranging in length from 5 to 9 mm.

Haplonyx ustipennis, Pasc.

Of the type of this species Mr. Gahan wrote me: -"There appears to be a second small tooth distal to the first on the front femora. It can be seen when looking at the femur from the posterior side, but is more or less concealed by a bunch of scales when seen from the anterior side. The second tooth is more conspicuous in a second specimen of the species."

Haplonyx modicus, n. sp.

Reddish-brown, in places obscurely stained with piceous; muzzle, club and tibial hooks black. Clothed with rather

thin and not very dense scales, varying from white to black, and forming feeble fascicles in places.

Rostrum almost straight. In male the length of prothorax; with coarse punctures, which behind insertion of antennæ cause an appearance as of seven fine costæ. In female the length of prothorax and scutellum combined, thinner but more dilated at apex than in male, and with smaller punctures and less conspicuous costæ. *Prothorax* densely granulate-punctate, and with a feeble median line. *Elytra* very little wider than prothorax, almost parallel-sided to beyond the middle; with rows of large and somewhat rugose but partially-concealed punctures; interstices with numerous small but frequently-concealed granules, and feebly tuberculate beneath fascicles. *Femora* strongly dentate, and each with a small supplementary tooth; front tibiæ strongly bisinuate, basal sinus the longer. Length, 5-5½ mm.

Hab.—Victoria: Grampians, Ararat (C. French).

On the prothorax the scales are either whitish or somewhat ochreous, and appear to form feeble oblique stripes; on the elytra similar scales are irregularly distributed, but to the naked eye the paler ones appear to be condensed into very feeble and thin transverse fasciæ. On the under surface, legs, head, and base of rostrum the scales are mostly of a dingy-white. The prothorax is without fascicles; but there is a rather large velvety spot, mostly behind, but partly on, the scutellum; and three feeble fascicles on the third interstice (of which only the median one is always traceable), and three still more feeble ones on the fifth (of which also only the median one is always traceable). The fascicles are composed of black or sooty scales, and these are very sparse on the rest of the elytra, and altogether absent elsewhere. With the head bent, the rostrum of the female extends fully to the abdomen.

Close to *ericeus*, but rostrum decidedly longer, thinner, and straighter, femora quite distinctly bidentate (in that species the second tooth is scarcely traceable). In *ericeus* the fascicles are composed of loosely-clustered scales and are rather long; in the present species they are shorter and closely compacted. In the present species also the median lobe or tooth of the front tibiæ is much more conspicuous. The general outline is much as in *cionoides* and *sexvittatus*.

HAPLONYX LATUS, n. sp.

Reddish-brown or dark-brown, in places darker. Moderately clothed with somewhat setose scales (except on the under-surface, where they are stouter), of three colours, white, ochreous, and black.

Rostrum rather wide, almost straight, about the length of prothorax in female, slightly shorter in male; basal two-thirds with coarse seriate punctures, and with five or seven feeble costæ, apical third with smaller and elongate but scarcely seriate punctures. *Prothorax* more than twice as wide as long, base feebly sinuated; with small, dense, and more or less concealed punctures. *Elytra* about one-third wider than prothorax, sides feebly dilated to middle, scarcely longer than wide; with regular rows of not very large and partially-concealed punctures; interstices much wider than punctures, and with numerous small but partially-concealed granules and punctures. *Femora* strongly unidentate; front tibiæ rather strongly bisinuate, basal sinus slightly shorter than the other. Length, 3½-4 mm.

Hab.—New South Wales: Mount Kosciusko, 5,700-6,000 ft. (R. Helms), Blue Mountains (E. W. Ferguson), Mount Victoria (A. M. Lea).

Of the three specimens before me one is almost piceous, but with the antennæ (including the club) paler; a second is of a rather light-reddish-brown, but with the apical two-thirds of the club almost black; the other is intermediate between these two, but its club is entirely pale, and the basal two-thirds of its rostrum almost black. The white scales are dense on the under surface and legs, and rather thickly scattered on the head, base of rostrum, and flanks of prothorax. The ochreous ones are rather thickly but evenly scattered on the prothorax (here, however, they are sometimes replaced by white ones) and sparsely on the elytra, except that they are dense about the scutellum (on one specimen they are dense almost to the shoulders) and on the second and third interstices towards the apex. The black scales are numerous (but from some directions indistinct) on prothorax and elytra, less numerous on the upper surface of the legs, and sparse on the head. The median costa of the rostrum is almost continuous to the apex, but between the insertion of antennæ it is longitudinally impressed in the middle, in two of the three specimens.

A wide, peculiar, and somewhat depressed-looking species with conspicuous rostral carinæ. The clothing on the apical portion of the elytra near the suture is faintly suggestive of *vicinus*; which, however, is very different in other respects. The black scales, although numerous, are very indistinct from most directions.

Haplonyx mucidus, n. sp.

Dull-reddish-brown, sides of sterna somewhat darker. Moderately clothed with whitish setose scales, paler and more regular on the under-surface and legs than on the upper-surface.

Rostrum stout and lightly curved, in female the length of prothorax, in male somewhat shorter; with dense punctures, coarse and irregular on basal two-thirds, and smaller towards apex. *Prothorax* not much more than once and one-fourth as wide as long; densely granulate-punctate. *Elytra* about one-fourth wider than prothorax; with rows of fairly large and deep punctures; interstices distinctly wider than punctures, with fairly large granules at base, becoming smaller or replaced by punctures posteriorly. *Femora* acutely dentate, and each with a small supplementary tooth; front tibiæ rather strongly and almost equally bisinuate. Length, 5-6½ mm.

Hab.—North-Western Australia (Macleay Museum).

On the prothorax the scales are denser at the sides than elsewhere, the disc at first appearing to be nude; but on close examination is seen to be clothed with fine short setæ; at the base, however, the clothing is as on the sides. The elytra appear to have three similar semi-nude spaces on each side: one close to base, one about middle, and one close to apex. There is a fairly distinct median costa on the basal two-thirds of rostrum, but no others can be distinctly traced.

In general appearance close to *seminudus*, but the prothorax and elytra nowhere really nude, although at a glance there appear to be nude spaces; the prothoracic granules and punctures are also not quite the same, and the elytral punctures are considerably smaller, with the interstices wider.

HAPLONYX (AOLLES) VARIEGATUS, n. sp.

Black, antennæ reddish; legs varying from almost entirely reddish to almost entirely black. Rather densely clothed with white, ochreous, and black scales.

Rostrum wide, straight, and flattened, scarcely more than twice as long as wide; the length of prothorax in female, slighty shorter in male; with dense punctures, more or less seriate in arrangement throughout, but leaving exposed several feeble costæ on basal two-thirds. *Prothorax* more than twice as wide as long; with dense but more or less concealed punctures. *Elytra* not much wider than prothorax, and not much longer than wide; with regular rows of not very large but deep punctures; interstices distinctly wider than punctures and apparently with numerous small granules or punctures. *Femora* strongly unidentate; front tibiæ strongly bisinuate; claw-joint of tarsi scarcely exserted beyond lobes of third. Length, 2¾-3 mm.

Hab.—New South Wales: Mount Kosciusko, 5,700-6,000 ft. (R. Helms); Tasmania: Bruni Island, Hobart, Summit of Mount Wellington (A. M. Lea).

The white scales are mostly confined to the under surface and legs, but a few are scattered about on the sides, and occasionally elsewhere on both prothorax and elytra; on one specimen they form numerous feeble spots on the elytra. The ochreous scales are dense on the prothorax and head; on the elytra in places they quite regularly clothe the interstices, but they are frequently interrupted by small spots of black scales.

In general appearance very close to *sordidus*, but claw-joint much less conspicuous, front tibiæ shorter, much more strongly bisinuate and less curved, femora unidentate and funicle with six instead of seven joints. In size and shape it is close to *rubiginosus*, Pasc., but is considerably darker, rostrum entirely black, etc.

HAPLONYX (AOLLES) MÆSTUS, n. sp.

Black or almost black, antennæ of a rather bright red. Densely clothed with soft white scales on under-surface and legs, sparse about eyes, condensed at sides of prothorax, about scutellum and base of elytra and a few scattered singly on elytra; rest of upper-surface and upper surface of legs with deep black scales.

Rostrum moderately wide, and almost straight, the length of prothorax; with coarse punctures, somewhat seriate in arrangement on the basal half, and smaller towards apex. *Prothorax* almost thrice as wide as long; punctures concealed. *Elytra* not much wider than prothorax, and very little longer than wide; with regular rows of not very large but deep punctures; interstices much wider than punctures. *Femora* strongly unidentate; front tibiæ strongly bisinuate; tarsi with claw-joint scarcely traceable. Length, 3½ mm.

Hab.—Victoria: Sea Lake (J. C. Goudie).

On the two specimens before me (each of which is probably a female) the white scales are very conspicuous about the scutellum; on one of them the base of the elytra has fairly numerous white scales elsewhere; but on the other there are very few except about the scutellum itself; on the rest of the elytra the isolated white scales are confined to the striæ. The antennæ are inserted rather nearer the middle of the rostrum than usual. Only the median costa is at all distinct on the rostrum, but feeble remnants of others can be traced.

The absence of a median and apical fasciæ from the elytra and the presence of white isolated scales in the striæ distinguish from *trifasciatus*. The prothorax at a glance appears to have clothing only at the sides, but this is due to the scales on the disc being as black as the derm on which they rest.

HAPLONYX (AOLLES) PUNCTICOLLIS, n. sp.

Of a rather light-brownish-red, head and a rather large patch on shoulders piceous. Under-surface and legs with moderately dense whitish scales; upper-surface with sparsely-distributed whitish scales, and with small indistinct reddish-brown ones.

Rostrum straight and rather wide, slightly shorter than prothorax; basal two-thirds with seriate punctures and distinct costæ; apical third with dense regular punctures. *Prothorax* about twice as wide as long; with dense, small, shallow punctures. *Elytra* very little wider than prothorax, and not much longer than wide; with regular rows of not very large but deep and subquadrate punctures; interstices much wider than punctures, and with numerous small granules. *Femora* strongly unidentate; front tibiæ strongly bisinuate; tarsi with claw-joint scarcely traceable. Length, $3\frac{1}{2}$ mm.

Hab.—Queensland. Cooktown (J. A. Anderson).

On the prothorax the whitish scales form a feeble spot in the middle of the apex, and feeble spots at the sides of the disc; the flanks, however, being rather densely clothed; but most of the scales are of a rather bright-reddish-brown, and indistinct from most directions. On the basal two-thirds of the rostrum there are four distinct but more or less oblique and irregular costæ, with a feeble median one. From some directions the prothoracic punctures appear to be placed in close concentric semicircles, of which the convex side is directed towards the base, their scales also are usually slightly depressed below the general level.

HAPLONYX (AOLLES) MINIMUS, n. sp.

Of a rather light chestnut-brown, in parts darker or not. Moderately clothed with large soft scales, mostly white, but somewhat variegated on prothorax and elytra.

Rostrum wide and straight; the length of prothorax in male, slightly longer in female; with dense punctures partially concealed on basal half. *Prothorax* about thrice as wide as long, punctures concealed. *Elytra* very little wider than prothorax, about once and two-thirds as long as wide, parallel-sided to beyond the middle; punctures more or less concealed. *Femora* very feebly unidentate; front tibiæ very feebly bisinuate; tarsi with the claw-joint very indistinct. Length, $1\frac{1}{3}$-$1\frac{3}{4}$ mm.

Hab.—New South Wales: Mount Victoria; Tasmania: Hobart (A. M. Lea).

Two of the specimens before me are (except as to the clothing) of a uniform shade of colour throughout; but most of them have the scutellum and most (in one specimen all) of

the under-surface black: the black, however, except as to the coxæ, does not extend to the legs. On the elytra the darker scales, which are usually of a dingy-brown, form feeble irregular spots, or are singly but thickly scattered; on the prothorax they do not appear to form spots. There are apparently regular rows of punctures on the elytra, but each puncture in the rows is almost or completely filled by a scale, so that the punctures themselves cannot be clearly seen, but they are narrower than the interstices: these apparently being without granules.

The smallest species of the subfamily known to me. *Uniformis*, the next smallest species, is decidedly wider in proportion, and differs in other particulars. The very short prothorax and comparatively long elytra are very distinctive features. From most directions the femora appear to be edentate.

SUBFAMILY ZYGOPIDES.

Metialma, Pascoe, Ann. and Mag., Nat. Hist., 1871, vol. vii., p. 217.

This genus of *Zygopides* has not hitherto been recorded as Australian. It may be recognized by the compact body, large and feebly-separated eyes, enormous side pieces of meso- and meta-sternum, *Læmosaccus*-like abdomen and pygidium, very stout femora, each armed with a very large triangular tooth, and by the curious basally-arched tibiæ. Pascoe was acquainted with 5 species, and speaks of their "very uniform and distinctive appearance," and the 5 species before me are almost identical in sculpture. Of the species that he described, the clothing of the present one apparently most resembles that of *scenica*, from India.

Metialma Australiæ, n. sp.

Black; antennæ, tarsi, and apical half of rostrum reddish, tibiæ obscurely diluted with red. Clothed with white more or less setose scales on setæ, closely applied to derm and irregularly distributed: elsewhere glabrous or with blackish scales.

Rostrum strongly curved; basal half with three acute carinæ, apical half shining and with very minute punctures. *Prothorax* moderately transverse, base much wider than apex, and strongly produced to middle; with a very feeble median carina; with small, dense, round punctures. *Elytra* cordate, not much longer than wide; with fairly deep punctures in narrow, sharply-defined striæ: interstices with numerous small punctures. *Femora* very stout, especially the front pair, and

all very strongly dentate, especially the front pair; front tibiæ very strongly arched at base. Length, $4\frac{3}{4}$ mm.

Hab.—Queensland: Cairns (probably collected by E. Allen or H. Elgner).

The white clothing is fairly dense on the basal half of the rostrum, forms a very narrow line between the eyes, forms irregular lines on the prothorax and numerous feeble spots on the elytra; there is, however, a conspicuous spot on the suture at apex and another on and about the scutellum. On the under-surface the white clothing is more regular, but there is a conspicuous dark spot on each side of each of the second, third, and fourth abdominal segments. On the four front legs the clothing is almost entirely white, but on the hind pair it is variegated with black. The inner base of the front tibiæ is supplied with long fine hair, but this may be confined to the male.

There is a second species of the genus in the Macleay Museum (from Cape York); it differs from the above species in having the eyes produced to a point on their lower edge, and the hind margin of each sinuous In *Australiæ* the eyes are evenly rounded externally and in front. I have not described the second species, however, as the only specimen before me is in bad condition.

MECOPUS TIPULARIS, Pasc.

This species extends from the Illawarra district to Somerset. It may be readily identified by its tridentate hind femora The clothing of the upper surface is mostly black, but with white or ochreous scales covering a variable amount of surface, but always less than in any other species before me. In size it varies from 5 to $6\frac{1}{2}$ mm.

MECOPUS MACLEAYI, n. sp.

♂. Black; antennæ and sometimes parts of the legs dull-red. Densely clothed with sooty-brown scales, with numerous white or whitish and pale-brown scales scattered about, and condensed into small spots. On the under-surface the pale scales are rather more numerous than the dark ones.

Rostrum scarcely twice the length of prothorax; apical half shining and with fine punctures, basal half subopaque and with coarser punctures; obtusely tricarinated Second joint of funicle slightly longer than first. *Prothorax* about twice as wide as the length down middle, with dense, normally-concealed punctures. *Elytra* subtriangular; suture and most of the interstices with a few small granules, third interstice with two or three small conical tubercles or teeth about the middle, and a stronger subapical one which projects slightly

beyond the tip; punctures partially concealed. *Prosternum* unarmed. Front *femora* longer than rostrum, finely and acutely dentate; hind femora each with a strong acute tooth and a smaller and more obtuse one; basal joint of front tarsus lightly curved, about half the length of its supporting tibia. Length, 4¾-5 mm.

Hab. -Queensland: Endeavour River (Macleay Museum).

The very long and thin legs and distinctly fimbriated front tarsi are proofs that the three specimens before me are males, although there are no pectoral spines; but two other species (*pulvereus* and *serrirostris*, both exotic and very different from the present species) are similarly unarmed.

The scutellum is conspicuously white, the paler scales on the prothorax form feeble lines fairly distinct to the naked eye but confused under a lens. The white scales, although not clothing the whole of the abdomen, are continuous across the four apical segments. On two specimens the apical half of the hind tibiæ is densely clothed with white scales. On one specimen on each elytron the third interstice has three small tubercles about the middle; on another there are two tubercles on each side, and on the other two on one side and three on the other.

MECOPUS PICTUS, n. sp.

Black: antennæ, rostrum (wholly or in part), and tarsi reddish; prothorax and elytra sometimes diluted with red. Rather densely clothed with scales varying from white (usually tinged with ochreous) to slaty-brown.

Rostrum not twice as long as eyes; apical third shining and with fine but distinct punctures, basal two-thirds with coarser but partially-concealed punctures, and with an acute median carina and several feeble sublateral ones. Second joint of funicle distinctly longer than first. *Prothorax* almost thrice as wide as the length down middle; punctures normally concealed. *Elytra* subtriangular; with series of large, suboblong, partially-concealed punctures; without small conical tubercles, but with fairly numerous granules, which on the third interstice form a feebly-elevated ridge about the base and middle. *Prosternum* unarmed. Front *femora* about as long as rostrum, each with an acute and rather small tooth, middle rather more strongly armed, hind pair each with a large triangular acute tooth; tarsi about as long as tibiæ, basal joint of each about half its total length. Length, 3½-5 mm.

Hab.—Queensland: Endeavour River, Cairns (Macleay Museum).

Three of the specimens before me are small and three are large, and these may represent the sexes: otherwise I am not

able to distinguish them, and quite possibly they are all females In Pascoe's table of the *Zygopides* the species would be placed in *Mecopus*, but the unarmed breast (in several species of *Mecopus*, however, the breast is unarmed in both sexes) and strongly unidentate hind femora are aberrant characters Probably had it been before Pascoe he would have referred it to a new genus, or perhaps to *Chirozetes* (which, however, has the breast armed in the male). From the species of *Mecopus* previously recorded from Australia it may be distinguished by its unarmed breast and unidentate hind femora In structure it closely resembles a species of *Agametis* in my collection, but the pectoral canal is absent.

On the prothorax there is a very conspicuous median stripe (strongly narrowed at its middle) of pale scales bounded by dark ones; on the sides the clothing is mixed. The scutellum has also very dense pale scales. On the elytra the clothing to the naked eye appears to be greyish, with two dark oblique stripes on each side, one commencing near the shoulder and reaching the suture about the middle, the other subapical. On the under-surface the clothing is mostly pale, but with dark spots on the sides of the sterna and on the intercoxal process of abdomen. The apical half of the hind tibiæ has conspicuous white clothing. The elytral granules are less noticeable on the small than on the large specimens.

TEMIALMA, n g

Head rather small. Eyes rather large, round, frontal, almost touching, finely faceted. Rostrum about the length of prothorax, rather thin, moderately curved; scrobes invisible from above, not extending to eyes. Antennæ rather thin, scape inserted about middle of rostrum, distinctly shorter than funicle; funicle seven-jointed, first two joints moderately long, the second longer than first; club elliptic, subsolid. *Prothorax* transverse, base strongly bisinuate, apex subtubular, ocular lobes very obtuse. *Scutellum* small. *Elytra* short, base closely applied to prothorax, shoulders rounded. *Prosternum* with a rather deep pectoral canal, bounded behind by narrow vertical walls. Mesosternum with large side pieces, the outer one of which appears like a wedge between the prothorax and elytra. Metasternum strongly convex, moderately long, episterna wide. *Abdomen* large, obliquely ascending to apex, two basal segments large, especially the first, third and fourth short. *Legs* not very long; femora stout, especially the front pair, and very strongly triangularly dentate: tibiæ curved and compressed; tarsi rather narrow. *Body* rhomboidal.

The large eyes (although occupying less of the head than in other genera), large and almost parallel-sided metasternal episterna, separating the hind coxæ from the elytra, and the pectoral canal indicate that this genus belongs to the *Zygopides;* although the side pieces of the mesosternum are suggestive of the *Baridiides* (as they are also in *Metialma*). In Pascoe's table of the *Zygopides*, if the pectoral canal is regarded as being limited behind it would be placed with *Nyphæba*, which has coarsely faceted eyes, pectoral canal as in *Idotasia*, and is otherwise different. Regarding the canal as being gradually effaced behind, it would be placed with *Telaugia*, which has linear femora and is otherwise different.

The walls of the pectoral canal behind the front coxæ appear to belong to the mesosternum, and it is only when the prothorax has been separated from the body that their true location can be proved, when they appear like two triangular flanges. Somewhat similar processes are to be seen in *Mechistocerus* and *Aonychus* of the *Cryptorhynchides*. The pygidium is distinct on four of the specimens under examination, but concealed on two others.

Temialma suturalis, n. sp.

Black; tip of rostrum and tibiæ dull-red, femora darker, tarsi and antennæ paler. Clothed with mixed black-and-white depressed setæ; suture with two distinct spots of yellowish setæ, one beyond the middle, the other (and smaller one) apical; rostrum glabrous, except about base.

Head with dense and rather small, clearly-defined punctures. Rostrum shining; apical half with a few small punctures at sides; basal half with two shallow grooves on each side, and with fairly numerous punctures on sides. *Prothorax* about once and one-fourth wider than long, sides moderately rounded; punctures as on head, but slightly larger. *Elytra* not much longer than wide, base trisinuate, sides nowhere parallel, suture strongly depressed towards base and slightly elevated towards apex; narrowly striate, the interstices with dense punctures as on head. *Under surface* with small dense punctures. Front *femora* very strongly dentate, the teeth compressed, the other femora with somewhat smaller but more acute teeth. Length, $3\frac{3}{4}$-$4\frac{1}{2}$ mm.

Hab.—Queensland: Endeavour River (Macleay Museum).

A larger percentage of the clothing is white on the under- than on the upper-surface. The apical half of the suture is densely clothed, but the clothing between the yellowish spots being of the same colour as the derm, is not conspicuous.

LAMITEMA, n. g.

Rostrum somewhat shorter than prothorax and not very thin, rather feebly curved. First joint of funicle longer and stouter than second, which is short and not much longer than third; club ovate. *Pectoral canal* distinct but not very deep in front, where it is bounded by thin walls, absent beyond coxæ. Other characters as in preceding genus.

The femoral teeth though large are narrower than in the preceding genus and the rostrum is somewhat stouter, but in all other generic characters it agrees with it, except in the pectoral canal; in the species described below it is fairly deep only in front of the coxæ, and absent behind, instead of being bounded by the remarkable flanges so noticeable in *suturalis*. At first sight the two species certainly appear congeneric, and even the clothing is somewhat similar.

In Pascoe's table of the *Zygopides* the genus would be placed with *Osphilia* and *Metialma*. The pectoral canal will distinguish it from *Metialma*.(7) *Osphilia* is very briefly compared with *Metialma*, but as its head is figured as being almost entirely occupied by the eyes, and Pascoe makes no mention of a pectoral canal, it appears best to refer it to a new genus rather than to risk placing it in one from which it is probably distinct.

LAMITEMA DECIPIENS, n. sp.

Black; antennæ and tarsi reddish, rest of legs obscurely or not at all diluted with red. Upper-surface with indistinct dark depressed setæ, and a number of spots of yellowish-white or ochreous setæ; clothing of under-surface mostly white, but denser and yellower on sides of three apical segments than elsewhere.

Head with small dense punctures. Rostrum about the length of front tibiæ, shining; with small punctures in front, becoming more distinct on sides and towards base; basal half with two shallow grooves on each side. *Prothorax* not much wider than long, sides moderately rounded; with dense and clearly-defined, but rather small punctures. *Elytra* not much longer than wide, base trisinuate, sides nowhere parallel, suture depressed towards base; narrowly striate, with fairly distinct punctures in striæ: interstices with rather dense punctures. *Under surface* densely punctate. *Femora* with large acutely-triangular teeth, those of the front pair largest. Length, 3-3¼ mm.

(7) Pascoe describes the rostrum of *Metialma* as being cylindrical at the base, but in four species of the genus before me (including the typical one, *nævea*) this does not appear to be the case.

Hab.—Queensland: Cairns (Macleay Museum).

The outlines are almost exactly as in the preceding species. There are at least four distinct spots of yellowish clothing on the prothorax, but generally more; on the suture there are three, one close to scutellum, one beyond the middle, and one apical—the latter two, however, are sometimes almost conjoined. On the rest of the elytra there are usually numerous very feeble spots, sometimes causing a feeble fasciate appearance. There is generally also a spot on the forehead.

AGAMETIS.(8)

This genus has not hitherto been recorded as Australian; but there is a species from North Queensland before me that undoubtedly belongs to it. This species agrees well—in shape—with Pascoe's figure of *festiva*, but is considerably smaller, with different clothing. The funicle is six-jointed, with the second joint long. The general appearance is of a small, pectorally-unarmed *Mecopus*. Pascoe describes the tarsi as *breviusculi*, but they are figured (pl. xix., figs. 5 and 5*b*) as rather long in the type, and they are rather long in the species before me.

AGAMETIS BIFASCIATA, n. sp.

Reddish, in some parts somewhat mottled with brown; antennæ and tarsi paler than elsewhere. Rather densely clothed with scales varying from almost white to rusty-brown.

Head with eyes occupying almost the entire upper-surface and very narrowly separated along middle. Rostrum rather long and thin, strongly curved, dilated and squamose near base, glabrous elsewhere; impunctate except near base. Scape about half the length of the funicle and club combined; second joint of funicle about twice the length of first, and the length of the four following combined. *Prothorax* more than twice as wide as the length down middle, apex rather strongly incurved to middle, the front angles produced into rather strong ocular lobes, base strongly bisinuate and much wider than apex; with small, dense, normally-concealed punctures. *Scutellum* transverse. *Elytra* not much wider than extreme base of prothorax, sides feebly diminishing in width from base to near apex, when they become strongly rounded: with regular rows of large punctures, in feeble striæ, but the striæ more pronounced and punctures smaller towards apex and sides; with two feeble but wide transverse impressions; with some very small granules, more noticeable on posterior declivity (especially on its summit) than elsewhere. *Under-surface* with dense but normally-concealed punctures. First

(8) Pascoe, Journ. Linn. Soc. x., p. 473.

segment of abdomen as long as three following combined, second also as long as three following combined. *Legs* moderately long; hind femora much longer than the others, strongly and acutely dentate, teeth of the other femora acute but smaller. Length, 5-5½ mm.

Hab.—Queensland: Cairns (Macleay Museum).

The clothing of the under surface and legs is denser and paler than elsewhere, but the legs have some dark spots or blotches; the prothorax has a faint median stripe and still fainter lateral ones. On the elytra there are two fairly distinct fasciæ of pale scales; one before and one behind the middle, and not quite extending to the sides; from the sides the fasciæ are seen to cover the surface of two transverse depressions; of which, however, the postmedian one is rather feeble.

PHAUNÆUS, n. g.

Head small. Eyes not very large; separated almost the width of rostrum at base; facets of moderate size. Rostrum very long, thin, and curved; scrobes lateral. Antennæ thin; scape not extending back to eye; funicle seven-jointed, two basal joints moderately long. *Prothorax* rather narrow at apex, increasing in width to base, which is almost evenly rounded; ocular lobes almost rectangular. *Scutellum* small. *Elytra* cordate, shoulders strongly rounded. *Prosternum* semi-circularly emarginate in front, but without a pectoral canal. *Metasternum* slightly longer than following segment; episterna narrow, but each with an acute triangular internal extension in front *Abdomen* with first segment rather large, second in middle very little longer than third or fourth, but at sides almost as long as the two combined. *Legs* long; front coxæ touching, middle lightly separated: femora edentate: four front tibiæ strongly curved; tarsi wide, third joint deeply bilobed, fourth rather short and stout, claws simple and widely diverging.

Apparently belongs to a group of aberrant genera referred by Pascoe to the *Zygopides*, but which eventually will have to be regarded as forming a distinct subfamily. In Pascoe's table of the *Zygopides* it would be placed with *Nauphæus*, as the intercoxal process, although fairly wide, is much narrower than in *Arachnopus*, but the two genera can have little in common, as the shape, antennæ, and rostrum are all different, and there is no pectoral canal. I know of no closely-allied described genus, although there are several unnamed ones before me. In shape the body is much like *Idotasia*, but that genus has a pectoral canal.

Pascoe's fig. 8 *(Thyestetha nitida)* on pl. xvi of Ann. and Mag., Nat. Hist., 1871 (vol. vii., ser. iv.), will give a

fairly good idea of the appearance of the insect described below.

PHAUNÆUS LONGIROSTRIS, n. sp.

Black, shining. Upper-surface glabrous except for some white scales on suture. Under-surface and legs with dense white scales in places; but glabrous elsewhere.

Head with small, dense punctures. Rostrum considerably longer than head and prothorax combined, with rather numerous punctures, except for an impunctate line along middle of basal three-fourths. Scape inserted about one-third from apex of rostrum, almost as long as funicle and club combined. *Prothorax* strongly convex; with rather numerous and small but clearly-defined punctures. *Elytra* strongly convex, at base closely applied to prothorax, but shoulders strongly rounded, thence rapidly diminishing in width to apex; with rows of rather small but clearly-defined punctures, becoming very small posteriorly, and in striæ only towards sides, and one near suture. Hind *femora* considerably passing apex of elytra. Length, $2\frac{3}{4}$-3 mm.

Hab.—Queensland: Cairns (E. Allen).

There are white scales on the suture near apex and some near base, but the latter appear to be easily abraded, as on several specimens they are absent, but their position is marked by minute punctures. The under surface of each of the femora has a ridge of scales, white at the base but darker near the apex, and these scales from some directions cause the femora to appear dentate, although they are really edentate. On an occasional specimen parts of the legs are feebly diluted with red.

TWO NEW NEPHILÆ FROM SOUTH AUSTRALIA.

By H. R. HOGG, M.A., F.Z.S.

(Communicated by Professor Stirling, M.D., F.R.S.)

[Read May 3, 1910.]

PLATE XVIII.

Among some spiders kindly sent me by Professor Stirling, Director of the South Australian Museum, Adelaide, I find the following of the Genus *Nephila*, Leach, collected in the State:—

Nephila venosa, L. Koch, from Sedan and other localities;
,, *victorialis*, L. Koch, from South Australia;
,, *eremiana*, H. R. Hogg, from Central Australia;

and two other species apparently new.

Of these I append descriptions below:—

NEPHILA MERIDIONALIS, n. sp.

Female.—Colour: The cephalothorax is black-brown in front, but thickly covered with silvery-grey hair behind the eye space. At the sides of the thoracic area are three pairs of black spots and one pair near the middle of the same; also, the usual pair of small black prominences at the rear end of the cephalic part, and quite at the rear end under the projecting abdomen a bare rhomboidal black space. The mandibles are black-brown; the lip and maxillæ black-brown, except on the inner and upper margins, which are red-brown. The sternum is dark-red brown, with silvery-grey hair, but the bare anterior portion and prominences in front of each coxa are pale-orange. The legs are bright-red brown; the coxæ, trochantera, and basal two-thirds of the femora being sparsely furnished with fine down-lying silver-grey hairs. On the anterior portion of the femora and tibiæ of the first and second pairs is a thick plumose bunch of brown hair, and similar on the tibia only of the third and fourth pairs. On the metatarsus and tarsus the hair is black. On the palpi the hair is dark-brown or black on the tibial and tarsal joints; on the remainder paler brown.

The abdomen is pale-yellow brown on the upper side, slightly darker in front, and at the sides sparsely furnished with fine silver-grey hairs. There are four pairs of brown muscle spots on the back. On the under-side behind the brown genital line a transverse yellowish space runs across,

and behind this is a yellow network pattern on a brown ground. The posterior portion is all dark-grey; the epigyne, pulmonary plates, and spinnerets dark-brown. The cephalothorax, straight and broad in front and rounded at the side, is flat over the thoracic part, the cephalic part being slightly raised up therefrom. The rear row of eyes is straight, the front row slightly recurved. The front median eyes are slightly larger than the rear median; those of each pair, and the pairs themselves, are the same distance apart, slightly more than the diameter of the larger. The side eyes, two-thirds the diameter of their respective median, are also slightly farther apart than the diameter of the larger, and lie on a common tubercle. The whole breadth of the front median pair separates them from their laterals, and the rear median are one-fifth more from the rear lateral. The clypeus is as broad as the distance between the front median eyes.

The mandibles are short, broad, and slightly divergent. The lip is broadest at the base, narrowing anteriorly. It is more than half the length of the maxillæ, and the upper portion projects forward over the base. The maxillæ are upright, rather club-shaped; the inner margin fits round the lip, and narrows posteriorly almost to a point. The anterior portion of these, also, is projected forward in a boss-like prominence. The sternum is shield-shaped, straight in front, narrowing to a point at the posterior end, where it passes between the rear pair of coxæ. There is a rather large prominence, and in front of the second and third pairs of coxæ are similar but smaller prominences. The whole of the anterior portion is raised up in a broad ridge, about equal in height to these. The legs are long and strong, with hair in bunches, as described above. The tibial joint of the palpi is the same length as the patellar joint. The abdomen is oblong, straight in front and at the sides, but rounded at the corners and rear end. The epigyne is of the normal type of the genus, but the middle of the upper lip expands into a rather broad septum.

This species is near *N. nigritarsis* of L. Koch, but has no separate pronounced hump on the front of the sternum behind the lip, the whole front area being raised up. The epigyne does not quite agree with that drawn by L. Koch, and the legs are not so long in proportion to the body.

The measurements in millimetres are as follow:—

	Long.	Broad.
Ceph.	14½	5½ in front 8 behind
Abd.	17½	9½
Mand.	4½	—

	Coxæ.	Tr. and Fem.	Pab. and Tib	Metab. and Tars.
Legs 1	3	17	15	21 = 56
2	3	15½	13½	19 = 51
3	2½	9	7	10 = 28½
4	3	15½	10½ (2·8½)	15½ = 44½
Palpi ...	1½	4	3½	3½ = 12½

There is one female from Kangaroo Island.

NEPHILA ADELAIDENSIS, n. sp

Female.—The cephalothorax is yellow-brown, thickly covered with silvery-grey hair. Three pairs of black side spots, one median, and a pair of black prominences. Mandibles chocolate-brown, darker at the anterior end. Fangs the same. Lip, maxillæ, and sternum medium yellow-brown, lighter at the edges of the former and on the humps of the latter. Thick, rough, silver-grey hair on the sternum. The legs are yellow-brown, with fine silver-grey hair on the under-side, rather darker at the anterior half of the tibial joints. The hair on the anterior half of the metatarsi and on the tarsi is dark-brown. The abdomen is yellow-grey above, with silver-grey, fine, down-lying hair all over. On the under-side it is dark-brownish-grey, with paler transverse and longitudinal stripes, forming a rhomboidal figure below the genital aperture. The spinnerets and epigyne are the same as the ground colour.

The general points of this species agree with *N. meridionalis* above. The cephalothorax is one and a half times as long as tibia iv. The rear row of eyes is straight, the front recurved. The eyes themselves are all about equal in size; the front median, however, slightly larger than the rest. The laterals are a little more than their diameter apart on a common prominence; the front and rear median one and a half times the diameter of the front eyes apart. The clypeus is the same in width. The legs are slight, and only moderately long; without spines. Short, thick hair on the metatarsus and tarsus of all legs. Fine hair on the under-side of the remaining joints. The patellar joint of the palpi is shorter than the tibial joint. The abdomen is straight in front, rounded at the corners and sides, tapering to the posterior end.

This species differs from *N. meridionalis* in its shorter and finer legs, its more oval abdomen, lesser distance between side and median eyes, want of plumose bunches on the legs, and lighter ground-colouring of the cephalothorax. The epigyne,

also, of the female is different, having no appearance of a septum.

The measurements in millimetres are as follow:—

	Long.	Broad.
Ceph.	9	$4\frac{1}{2}$ in front 6 behind
Abd.	11	$5\frac{1}{2}$
Mand.	4	—

	Coxæ.	Tr. and Fem.	Pab. and Tib.	Metab. and Tars.
Legs 1 ...	2	13	$11\frac{1}{2}$	$16\frac{1}{2}=43$
2 ...	2	12	10	$14\frac{1}{2}=38\frac{1}{2}$
3 ...	$1\frac{1}{2}$	7	5	$8\frac{1}{2}=22$
4 . .	2	12	7	$12\ =33$
Palpi ...	1	3	$2\frac{1}{2}$	$2\frac{1}{2}=\ 9$

One female from South Australia, without nearer designation.

DESCRIPTION OF PLATE XVIII.

1. *Nephila meridionalis*, n. sp., natural size.
   a. Under side of abdomen.
   1b. Eyes.
   1c. Epigyne.
2. *Nephila adelaidensis*, n. sp.
   1a. Under side of abdomen.
   2b. Eyes.
   2c. Epigyne.

LHERZOLITE AND OLIVINE FROM MOUNT GAMBIER.

By EVAN R. STANLEY.

[Read August 2, 1910.]

PLATE XIX.

Introduction.

In a previous paper before this Society [1] mention was made of lherzolite nodules occurring at Mount Gambier, but having only a limited supply of the material in my possession at the time I was unable to present a chemical analysis of the rock. Since then more material has come to hand from that locality, thus enabling me to make further petrographical notes and analyses on not only the lherzolite, but the olivine contained in it.

Lherzolite.

Occurrence.

The rock occurs in the form of nodules in the ash-beds overlying the basaltic flow at Mount Gambier. They vary in size from a few centimetres up to thirty centimetres or more in diameter. In the majority of cases the nodules are coated with a layer of vesicular-olivine-basalt or tachylyte. The nodules examined were selected from the ash-beds in Brown Lake, about 200 ft. above the water-level, where they occur in great numbers.

Macroscopic Characters.

In hand specimens the rock is olive-green in colour, even-grained, but coarse, containing allotriomorphic fragments of light-olive-green olivine, light-brownish-green rhombic pyroxene, dark-green particles of diallage, and black glistening grains of chromite.

The specific gravity of the rock is 3·33 at 16° C.

Microscopic Characters.

Owing to the extreme friability of the rock a difficulty was encountered in the preparation of microscopic sections, but by cutting a fairly thick section and boiling it in Canada Balsam, sections of suitable thickness were obtained. The rock is hypidiomorphic, even-grained, containing olivine,

(1) Trans. Roy. Soc., vol. xxxiii., 1909, p. 82.

enstatite, diallage, and chromite The pyroxenes are slightly idiomorphic, moderately large, and embedded in a granular mass of olivine, thus presenting a pseudo-porphyritic structure.

The olivine is by far the most abundant mineral. There is an indication of the (001) cleavage in some sections. A fair amount of cracking has gone on, with little or no decomposition to serpentine, but in some instances slight brownish stains of ferric oxide are seen; this, however, is visible only in the vicinity of a few microscopic grains of magnetite. A few liquid inclusions are present. In order of abundance the rhombic pyroxene, enstatite, follows the olivine. It is light-brownish-green in colour, slightly idiomorphic, enwrapping a few grains of olivine and diallage in a pœcilitic manner (plate xix., figs. 1 and 2). The (110) cleavage is well developed, being, in some instances, broken up into parallel plates along this parting. The basal sections show two good pinacoidal cleavages intersecting at 88°, together with a less perfect cleavage at 45°. Decomposition to bastite is common, especially in the vicinity of cracks (plate xix., figs 2 and 3). Columnar structure is well developed. In crossed nicols good lamella twinning is seen to advantage (plate xix., fig. 4), and in some cases the lamellæ may be seen in ordinary light.

The enstatite and diallage afford a good instance of lamella intergrowths with one another (plate xix., figs. 2 and 4). When the enstatite is in the position of extinction the diallage, in the same combination, is extinguished at only 39° from this position. In convergent polarized light a large optical axial angle is seen. The sign is positive, and the dispersion $\rho < \nu$, which is an indication that the mineral is low in iron. A few liquid and magnetite inclusions are present.

The diallage, which occurs in irregular grains of a light green colour, is probably chrome-bearing. Some sections show two fair pinacoidal cleavages intersecting at 89°, whilst others show a good prismatic cleavage. The extinction, which is 39°, is the chief distinguishing character from the enstatite. Decomposition is rarely seen in most sections, but in sections near the tachylytic coating the diallage is, to a considerable extent, decomposed to chlorite and epidote. In the undecomposed sections liquid inclusions are seen. The chromite is present in small rounded or irregular brown grains.

The minerals in contact with the tachylytic coating are partially absorbed by it. Leucoxinization has gone on to a considerable extent just within the junction of the tachylyte, proving that the magnetite present is titaniferous.

Order of Consolidation.

Chromite
Olivine
Diallage
Enstatite

The tachylytic coating consists essentially of a light-brown glass crowded with magnetite grains, rendering it almost opaque. A few partially-absorbed grains of olivine and augite are scattered about with little or no felspar.

The nodules under consideration are thus plutonic in origin and allied to the Enstatite Peridotites.

Chemical Composition.

Two very concordant analyses were made by the author and a mean taken.

The usual methods recommended by Hillabrand and Washington were followed. The ferrous iron, however, was determined by the method recommended by P. G. Wykeham Bayly,(2) *viz.*, by heating one gram of the substance in a covered platinum crucible with H_2SO_4 (1-1) and HF for ten minutes on an iron plate, and then titrating with standard permanganate of potash. Several determinations were made with and without the use of CO_2 with satisfactory results. Combined water was determined by the Penfield method, and the usual colourometric methods for titanium and chromium. Barium and strontium were not determined spectroscopically.

Results of Analysis.

SiO_2	45·22
Al_2O_3	2·99
Fe_2O_3	·20
FeO	7·17
MgO	40·89
CaO	1·93
Na_2O	·55
K_2O	·21
H_2O +	·20
H_2O −	·05
CO_2	nil
TiO_2	·14
P_2O_5	·20
Cr_2O_3	·20
NiO, CoO	·14
MnO	·28
BaO	nil
SrO	·04
	100·41

The Norm.

Orthoclase	1·11
Albite	4·72
Anorthite	4·73
Diopside	3·07
Hypersthene	14·72
Olivine	70·44
Magnetite	·23
Ilmenite	·30
Apatite	·31
Chromite	·22
Water	·25
	100·10

(2) Recent Methods of Rock Analysis. A.A.A.S., 1907

Classification.

Class V. Order 1. Section 4. Rang 1. Section 1. Subrang 1.

Magmatic name, *Gordunose*.

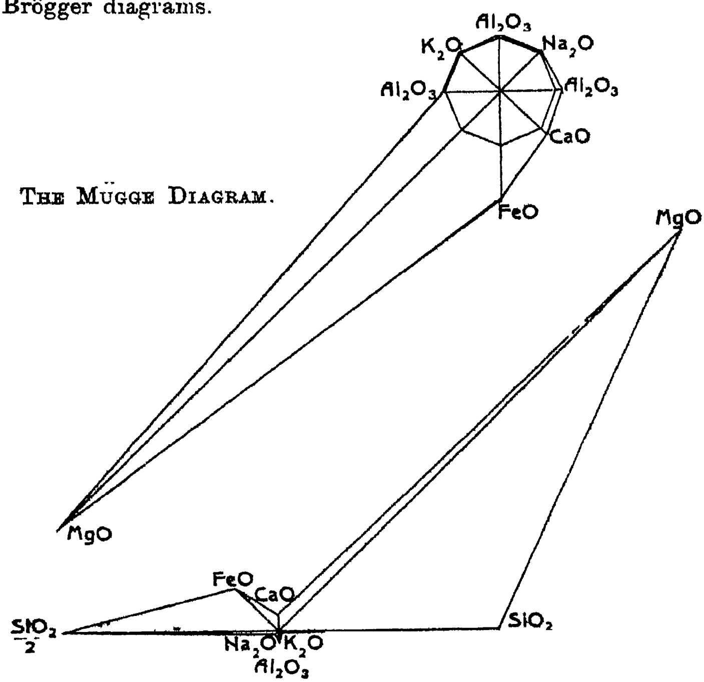
Notes on the Analysis.

It will be seen from the analysis that the rock contains noticeable percentages of Al_2O_3, K_2O, and Na_2O. These constituents have been allotted to form orthoclase, albite, and anorthite. These minerals do not occur in the mode, consequently the Al_2O_3, K_2O, and Na_2O are present in the ferromagnesian minerals.

In the analysis of the olivine extracted from this rock no alkalies or alumina were detected, therefore these constituents must be combined in a complex fashion in the pyroxenes.

Chemical Diagrams.

The following chemical diagrams have been inserted to convey a better idea of the relative amounts of the constituents present. They are respectively the Mügge and Brögger diagrams.



The Mügge Diagram.

The Brögger Diagram

Olivine.

Analysis.

Acting on the advice of Dr. D. Mawson, the author has made a chemical analysis of the olivine in the rock. The rock being of a friable nature, little difficulty was encountered in hand-picking the olivine and separating it from the other constituents present. Several grams of the mineral were in this way collected and powdered up, first in a diamond mortar, and finally in an agate mortar.

A mean of two concordant analyses has been taken, and is shown as follows:—

SiO_2	40·67
Al_2O_3	nil
Fe_2O_3	·10
FeO	9·27
MgO	49·94
CaO	trace
H_2O+	trace
K_2O	nil
Na_2O	nil
TiO_2	·04
Cr_2O_3	·03
MnO	·10
NiO,CoO	·25
	100·40

Specific gravity = 3·34.

In the analysis of the lherzolite it will be seen that there is a notable quantity of nickel present. The presence of nickel is certainly not uncommon in the rocks of this class. If we compare the percentage of nickel in the rock with that in the olivine extracted from it, we find that the proportion is less in the former than in the latter by nearly half. Consequently most, if not all, of the nickel in the rock is present in the olivine. Diller and Clark (3) have shown that most of the nickel present in peridotites is in the olivine. They extracted the olivine from the rock, and found it to contain a greater proportion of nickel than the rock itself.

Remarks.

Unchanged occurrences of peridotite are not at all common, the peridotites being, as a class, very liable to alteration, the chief alteration product being serpentine.

(3) B.U.S.G.S., 60, p. 28, 1890.

The lherzolite described in this paper affords a good example of an unaltered peridotite, no serpentine being observed microscopically, and a low percentage of ferric oxide and no carbon dioxide by analysis.

In conclusion, I wish to convey my thanks to Dr. D. Mawson for advice and assistance in the preparation of this paper.

University of Adelaide.

EXPLANATION OF PLATE XIX.

Fig. 1. Basal section of enstatite, showing outlines of lamellæ twinning and pœcilitically intergrown olivine (×15)

Fig. 2. Vertical section of enstatite, showing partial decomposition to bastite and pœcilitically intergrown diallage (×15)

Fig. 3. Section, showing enstatite with bastite, olivine, diallage, and chromite. (×15)

Fig. 4. Lamella twinning and parallel intergrowths of diallage with enstatite. Crossed nicols (×42)

Enstatite-Basalt from Kangaroo Island, South Australia.

By Evan R. Stanley.

[Read August 2, 1910.]

Plate XX.

Introduction and Previous Work.

During the Christmas vacation of 1909 a trip was taken to Kangaroo Island for the purpose of collecting specimens of the basalt occurring in the Menzies District. One of the objects of the present paper is to compare the Kangaroo Island basalt with the other tertiary outflows occurring in the south-eastern portions of South Australia The paper also includes a chemical analysis of the rock with petrographical descriptions.

About a quarter of a mile north of Kingscote the basalt rests on an eroded valley of white friable sandstone, which extends in a westerly direction towards the Bluff in the Bay of Shoals. It forms a capping on the hills a few miles inland to the west, extending from Rettie's Bluff to the western gap hills near Smith's Bay. But since the geology of this part of the district has already been published, no further reference will be made to it.

Professor Tate's (1) and Rev. W. Howchin's (2) papers, and the Report of Mr. H. Y. L. Brown on the geology of Kangaroo Island,(3) have been referred to in the preparation of this paper.

Dr Chewings (4) and Mr. J. C. Moulden (5) have each described an olivine basalt from Kangaroo Island.

I can find no further literature on the geology and occurrence of basalt on Kangaroo Island.

Enstatite Basalt. *Rocks 6-11.*

Macroscopic Characters.

In hand specimens the rock is fine-grained, compact, showing a few phenocryst of felspar and pyroxene not exceeding 3

(1) Trans. Roy. Soc., S.A., vol. vi., p. 116.

(2) Proc. Roy. Soc., S.A., vol. xxiii., p. 198.

(3) Report by the Government Geologist, S.A., 1898.

(4) Geologie Süd- und Central-Australiens. Inaugural-Dissertation zur Erlangung der Doktorwürde—1894.

(5) Trans. Roy. Soc., S.A., vol. xix., p. 70.

or 4 millimetres in length. The colour varies from a brownish-grey to an almost black, pitchy-looking rock. In rocks Nos. 6, 10, and 11 decomposition has gone on to a great extent, giving the rocks a greenish appearance, which is probably due to the alteration of the ferromagnesian mineral to serpentine. The locality from which rocks Nos. 6 and 9*a* were collected furnishes a good instance of columnar jointing. Use is made of this character in the quarries near Kingscote and the Bluff, the rock being sufficiently weathered to render it easily workable for road metal. The rocks collected from the Gap Hills also show jointing developed to a less degree, being more or less stained with ferric oxide. As far as hand specimens are concerned, the rocks are very similar to one another

Microscopic Characters.

The rocks have a hypocrystalline porphyritic structure, the phenocrysts being augite, enstatite, and plagioclase, irregularly distributed in a base of microlitic plagioclases and augite, with a small proportion of glass in the interstices. Of the phenocrysts, the augite is by far the most abundant constituent, possessing only the faintest indication of a light-green colour. They are cracked about a good deal, and somewhat corroded by the base, whilst others again possess a good idiomorphic outline.

The majority of these phenocrysts are intergrown with the plagioclase of the base in an ophitic manner (plate xx., fig. 1). Twinning is not an uncommon feature, and more rarely an hour-glass structure is developed. In the fresh varieties of the rock only a slight decomposition to a brown stain is noticeable in the cracks.

The mineral next in abundance is the enstatite, being corroded to a greater degree than the augite, and including a few tabulæ of felspar. The phenocrysts of the enstatite are, in a great many instances, partially or wholly enwrapped by the augite. The enstatite has evidently crystallized out first of the ferromagnesian constituents, and the augite has used it as a nucleus to crystallize on later. In two or three instances cited the corroded enstatite has a distinct resorption rim developed, and the augite has crystallized around the whole. The difference between the enstatite and augite in such a combination is particularly marked when examined between crossed nicols; the former, when in the position of extinction, shows the coloured envelope of augite which is extinguished at only 45° to this position.

The ferromagnesian constituents as a whole are nearly colourless, and this may account for the relatively low per-

centage of iron in the analysis. Decomposition has, to a slight extent, gone on, resulting in the formation of bastite.

The plagioclase, which is not plentiful as a phenocryst in this particular rock, has, in most instances, a well-defined idiomorphic outline. The phenocrysts almost always contain inclusions of apatite and dark-brown glassy base. In polarized light twinnings after the Carlsbad and Albite law are found to be common, whilst twinning after the pericline law is not so frequently met with. In most cases they are beautifully zoned (plate xx., fig. 2). Symmetrical extinctions up to 40° were obtained, therefore the plagioclase is probably a labradorite.

The base consists essentially of tabulæ of plagioclase felspar, twinned usually after the Carlsbad law, and giving a maximum extinction of 37°, which means that it is probably a labradorite a little more acid than the phenocryst. They possess, for the most part, an idiomorphic outline, and only slightly decomposed. A few granules of augite are also present, together with a few scattered grains of magnetite which are, no doubt, titaniferous, because of the presence of leucoxine. The interstitial material of the base is particularly interesting, in that it has, for the most part, become devitrified to a granular or fibrous mass possessing many microscopic grains of magnetite and a few needles of apatite.

The slides examined, representing rocks from different points of the occurrence, were more or less similar. Consequently there seems little doubt, if any, that the whole occurrence is contemporaneous. However, a few differences of minor importance occur. In rocks Nos. 6 and 10 decomposition has gone on to a great extent. Hæmatite is present in red scales, and also staining the augite yellowish-brown. Some of the augite has altered to serpentine and the enstatite to bastite. Again, in rock No. 11 the felspar phenocrysts are present in a greater proportion than the enstatite, whilst in rocks Nos. 7, 8, and 9 the reverse is the case.

Order of Crystallization.

Magnetite ... ...
Plagioclase (phenocryst)
Enstatite ... ...
Augite ... ...
Plagioclase (microlite) ...
Glass ... ...

Chemical Analysis.

The rock chosen for analysis was selected from a point about half a mile inland from the Bluff. Here the rock

appeared to be in a fairly undecomposed condition, for in most other localities weathering has deformed the rock both mechanically and chemically.

Results of Analysis.

	I.	II.
SiO_2 ...	53·18	53·11
Al_2O_3 ...	17·61	15·55
Fe_2O_3 ...	1·59	1·26
FeO ...	6·47	7·17
MgO ...	6·59	6·50
CaO ...	10·42	8·93
Na_2O ...	2·03	3·03
K_2O ...	·70	·28
H_2O+	·40	3·12
H_2O-	·33	·04
CO_2 ..	trace	·32
TiO_2 ...	·78	·40
P_2O_5 ...	trace	—
SO_3 ...	nil	—
S ...	trace	0·4
Cr_2O_3 ...	trace	—
NiO, CoO	trace	—
MnO ...	·10	·59
BaO ...	·13 (6)	—
SrO ...	·02 (6)	—
Fe ...	—	·03
	100·35	100·37

Sp. Gr. 2·88. Sp. Gr. 2·91

The Norm.

Quartz	5·52
Orthoclase	3·89
Albite	17·29
Anorthite	36·97
Diopside .	12·17
Hypersthene	19·96
Magnetite ..	2·32
Ilmenite .	1·52
Water	·73
	100·37

I. Enstatite basalt, Kangaroo Island, S.A.

II. Augite andesite (altered). Summit of Mount Anketel, West Pilbarra Goldfield. (Geol. Sur., W.A., Bull., No. 33, p. 148.) (Fe = ·03.)

Classification.

Class III. Order 5. Rang 4. Subrang 3.

Magmatic name, *Auvergnose*.

Notes on the Analysis.

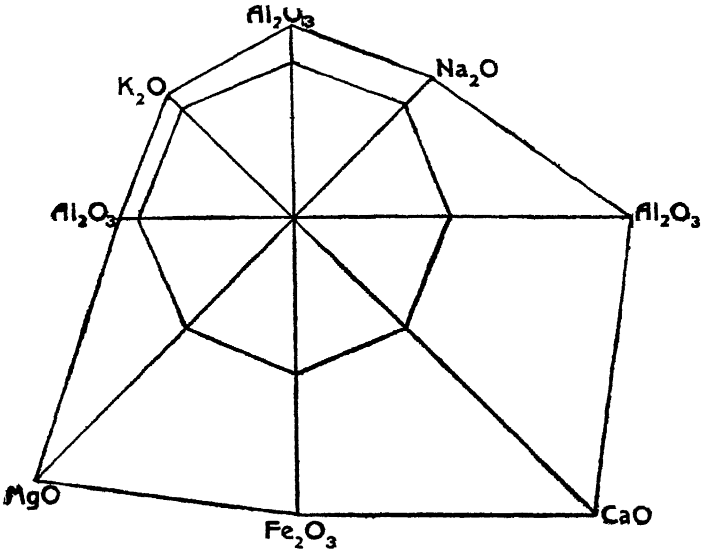
The rock is particularly interesting in that it is high in silica and alumina, thus accounting for the presence of abnormative minerals. It will be seen that quartz is present in the norm and is completely absent in the mode. Since the American classification does not take into account whether a mineral is crystalline or glassy it is probable that the excess

(6) Not determined spectroscopically.

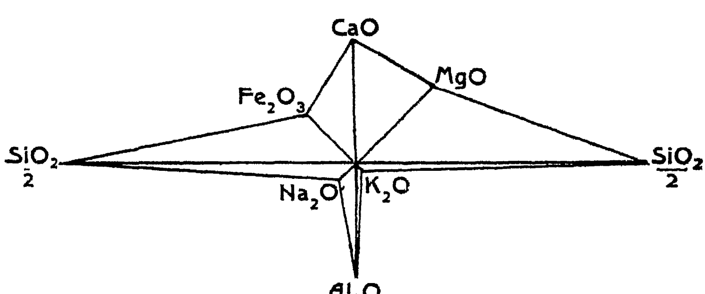
of silica is present in the divitrified base together with some of the alumina. Analysis II., which has been inserted for comparison from Western Australia, shows an interesting analogy, most of the constituents agreeing closely, with the exception of alumina and lime This particular rock contains phenocrysts of augite, felspar, olivine, and a little quartz in a ground mass of plagioclase and altered glass.

Chemical Diagrams.

The following diagrams have been employed to facilitate the comprehension of the chemical analysis:—



THE MÜGGE DIAGRAM



THE BRÖGGER DIAGRAM.

Remarks.

It is an interesting point to consider whether the Kangaroo Island outflow was synchronous with the volcanic eruptions in the south-eastern portion of South Australia. The basalt occurring in the Mount Gambier district is, however, of late tertiary or pleistocene age. The rock is, for the most part, very little decomposed. The fragments of basalt and lherzolite which occur in the ash-beds overlying the basalt are exceptionally fresh,[7] and as far as I can ascertain there are no instances where valleys have been cut through this basalt, or capping hills, as is the case on Kangaroo Island.

Returning to the Kangaroo Island occurrence, we find that a great deal of denudation and weathering has gone on. The basalt, which is probably contemporaneous, has been cut through by valleys. It also caps the hills in the vicinity of Wisanger, and occupies an eroded valley near Kingscote about 100 ft. above sea-level. The rock itself is decomposed to a greater extent than the Mount Gambier type. Instead of being, for the most part, an olivine-basalt, it is an enstatite-basalt, although an olivine-basalt has been described by Dr. Chewings and Mr. J. C. Moulden. The evidences of weathering are particularly marked in the quarries at the Stone Jetty and the Bluff, where columnar jointing is developed to a great extent, thus causing the rock to break up easily with the aid of a pick. Personally, I do not think that the Kangaroo Island basalt was synchronous with the occurrence in the South-East, but, from the above considerations, believe it to be a tertiary outflow earlier than the Mount Gambier type.

Acknowledgments.

In conclusion, I desire to extend my thanks to Dr. Mawson and Dr. Cooke for the interest they have shown in the preparation of this paper.

University of Adelaide.

EXPLANATION OF PLATE XX.

Fig. 1. Phenocrysts of augite and enstatite, containing tabulæ of microlitic plagioclase. (×25) Crossed nicols.

Fig. 2. Phenocryst of labradorite, showing zonal structure, and inclusions of base. (×18) Crossed nicols.

(7) Trans. Roy. Soc., S.A., pres. vol. Analysis of Lherzolite.

Notes on Some Species of the Isopod Family Sphæromidæ from the South Australian Coast.

By W. H. Baker, F.L.S.

Part II.

[Read September 6, 1910]

Plates XXI to XXIV.

In my notes on this family of Isopods published in these Transactions for 1908, I included what appeared to be a form of *Cymodoce tuberculosa*, Stebbing, showing that while my specimens agreed largely with the original species, yet they were different chiefly in that the male had two processes on the anterior portion of the abdomen; these I regarded as sexual the innermost and outermost being small. The antero-lateral developments are not shown in younger males. Since then I have examined a colony of *C tuberculosa*, which were found in a sponge, and in that there were males, certainly mature and of uniform size, bearing no indications of processes: also mature females and immature specimens; these I have figured in this paper.

With regard to the first-mentioned, I now endeavour to show them as a distinct variety or sub-species, and add figures and notes of a probable female and a rather more doubtful immature male and female

Respecting the mature female of *C. tuberculosa*, it will, from an examination of the figures, be surmised that at no stage of its existence does it possess a notch on the posterior margin of the abdomen. I do not think sufficient distinction has been made in descriptions between the longitudinal channel referred to by Dr. Hansen and the notch, which are quite different structures. In all the examples under *C. tuberculosa* and varieties here given a channel is present and its exit open, except in the case of the immature male of *C tuberculosa*, where it shallows away not reaching the margin, thus leaving it without insinuation of any kind, either in the vertical or horizontal direction, yet even here may be seen by a transparency of the integument the promise of a future notch. In the supposed mature female of the larger variety the true notch is faintly represented by two shallow insinuations of the margin.

In all the specimens included under this species and varieties the palps of the maxillipeds—except, of course, in modi-

fied females—are of the same curious structure, the lobes are long and, especially the last, carry dense brushes of setæ.

From observations of the three species—namely *Zuzara*, *Isocladus*, and *Exosphæroma*—included in this and other papers, I agree with Dr Hansen as to their close relationship and the necessity of uniting them. As there are no longitudinal channels for the passage of currents of water beneath in these three species, the same can evidently be provided for by the large uropoda set in oblique direction.

In my opinion *Cycloidura venosa*, Stebbing, and *Zuzara integra*, Haswell, are the same species, and I have treated them as such.

The descriptions always refer to the male except when otherwise stated.

Family SPHÆROMIDÆ.

Subfamily Sphærominæ, Hansen.

Group Hemibranchiatæ, Hansen.

Genus *Cymodoce*, Leach.

Cymodoce tuberculosa, Stebbing. Pl. xvi., figs. 1 to 20.

Cymodoce tuberculosa, Stebbing, Ann. and Mag. Nat. Hist., ser. 4, vol. xii., 1873, p. 95.

Cymodoce tuberculosa, Whitelegge, "Thetis," Scientific Results, p. 258.

The body, except the head and first thoracic segment, is covered with granules, which become spiniform and arrange themselves in two transverse rows with smaller granules between on each thoracic segment; small stiff hairs are scattered amongst the granules, and are fairly plentiful.

The forehead, which is gradually declivous anteriorly, is slightly excavate in the transverse direction, and higher up a faint rounded projection can be detected.

The eyes are large and scarcely project.

Indications of two depressed and coalesced rostral teeth are present, while the two epistomial teeth are large and recurved, like those of the basal antennular joint, projecting further than these. The antennular teeth are six in number, the innermost and outermost being small.

The antero-lateral angle of the first thoracic segment is produced somewhat, truncated at the tip, and the groove of the head in which it works is deep; the posterior angle is less produced. The three following epimera are obtusely pointed, the first and second of these slightly produced behind; the following three are rounded, the last more so, and it does not reach the level of the ones which precede it.

The posterior portion of the abdomen is somewhat excavated at the origin of the uropods. The posterior margin has a small notch on each side above the median notch. The median notch is deeply cut, widens inwardly, the median process is raised, and does not nearly reach the level of the sides.

The outer branch of the first maxilla has the outermost distal spines compacted together, thus forming an apparent 5-dentate plate; the next spine below this is 3-branched, while between these are slenderer setæ. The inner branch has four plumose setæ.

The two outer lobes of the second maxilla are setose and obliquely truncated.

The legs are robust and spinulate on the usual joints. The spines are usually long, and some are barbed or pectinate.

The uropods are very granulate to spiniform, especially underneath; the terminal spine on the inner ramus is recurved, and there are two well-developed spines at its base underneath. The external ramus is much shorter and deeply bifid, with its wider surface presented outwards.

The sternal filaments are short and stout.

The mature female has the body loaded with young, and the mouth parts are modified.

The body is smooth and slightly setose.

The basal joints of the antennules have a faint slightly-lobed crest, but there are no projecting, rostral, or epistomial teeth.

The posterior margin of the abdomen is turned up, showing a wide shallow insinuation in place of a longitudinal channel.

The uropods are reduced.

The marsupial plates overlap.

In the immature male the body is shorter and broader, smooth, very sparingly setose.

The upper angles and sides of the face anterior to the eyes are very distinct.

The posterior angle of the first thoracic segment seen from below is broadly truncated, the truncation with a slight insinuation.

The second, third, and fourth thoracic epimera are rather narrowly pointed.

The posterior margin of the abdomen is arcuate and quite entire, the longitudinal channel shallowing away completely at its exit.

The uropods are a little roughened on the margins, the inner ramus accuminate and laminate with a slight groove on the inner margin, the outer margin more distinctly grooved

to hold and partially cover the external ramus. The external ramus is shorter than the inner and bifid at the end

Budding sternal filaments are present, but there is no *appendix masculina*

The colour is light-brown with black pigment, which in some specimens is coarse and striped with a wider median stripe; other specimens have more dendridic spots, in some parts there being a bluish tinge—spirit specimens. Females with young have a bleached appearance, with small black spots not very numerous. The adult males are somewhat between these two as to colour. The adult males vary a little in size among themselves, while the females are a little larger.

The young ready to quit the parent have the end of the abdomen pointed like that of the immature male of the next variety.

Cymodoce tuberculosa, *n. var.* **bispinosa.** Pl. xxi, figs. 21 to 23; Pl. xxii, figs. 1 to 7.

Cymodoce tuberculosa, Baker, Trans Roy Soc, S. Aus., vol. xxxii., 1908, p. 140, pl. iii.

Besides the two processes on the anterior portion of the pleon, the following differences may be noted: -

The body is rather less granulated.

The posterior portion of the abdomen is not so excavated at the bases of the uropods, and there is a small conical tubercle beneath each process of the anterior portion.

The notch of the posterior border is much more open, and the excavation is not so broad at its base, and the median process is not so much raised, and just reaches the level of the sides. The more external notches noted in *C. tuberculosa* are seen below only as small tubercles, scarcely reaching the margin.

The epistome has the two tubercles much reduced, while the rostral pair are quite prominent.

The antennular teeth are 5-6 in number.

The sternal filaments are long and slender.

The difference in size also is considerable.

The specimen regarded as the mature female has the body comparatively smooth and the hairs scanty, except that on the segments corresponding with the male there are transverse rows of very minute granules arranged in two lines as the spines of the male.

The epimera of the thoracic segments are like those of the male, and like it there is a faint rounded tubercle on the forehead.

There are no indications of processes on the anterior portion of the abdomen; the abdomen itself is minutely granulate, and close to the posterior margin the surface is flattened or slightly turned up. The exit to the moderately deep longitudinal channel is open, and two faint insinuations of the margin are all that there is of a notch.

The uropods are reduced, scarcely compressed, and slightly rough; each inner ramus is tipped with a small tooth, and the outer rami, which are shorter, are slightly bifid.

The outer surface of the basal antennular joint bears a row of small spinulate granules: but there are no teeth, nor are there rostral or epistomial teeth.

The mouth parts are modified, but not strikingly so; the palps of the maxillipeds bear long lobes, but they are destitute of setæ.

The epistome is rounded and rather swollen anteriorly, and is setose.

The legs are slightly less robust than in the male

A supposed immature male of this variety resembles much that of *C. tuberculosa*—except again in size. The body is rather more elongate, and apparently budding processes are to be found on the anterior portion of the abdomen.

There are no indications of rostral, antennular, or epistomial teeth.

The uropods are laminate and rather abruptly acuminate.

The posterior portion of the abdomen is very obtusely pointed, with the exit of the channel almost vanishing.

The epimera of the second, third, and fourth thoracic segments are more narrowly pointed.

The posterior angles of the thoracic segment are similarly truncated, as in *C. tuberculosa.*

Budding sternal filaments are present, but there is no *appendix masculina.*

In the collection there is one immature female similar to this.

I have figured an immature male, which I think should be placed here (plate xxxii., figs. 3, 6, and 7), with a slightly different abdomen and with epistome more like that of the mature female recorded above; this one, it will be seen, has a more pointed abdomen with commencing processes on the anterior portion, with small tubercles near them; the channel also is similar to the mature female, except that the insinuations of the margin are not present. The sternal filaments are moderately long.

There are three immature females in the collection closely resembling this, except having no protuberances on the anterior portion of the abdomen.

Measurement of these four, about 8 mm. long by 5 mm. wide.

Measurement of *C. tuberculosa*, 5 mm. by 2½ mm.

Measurement of *C. tuberculosa*, var. *bispinosa*, 7 mm. by 3½ mm.

All specimens are from South Australian coast.

Cymodoce septemdentata, n. sp. Pl. xxii, figs. 8 to 17.

The body is rather narrow, very convex, with the sides nearly straight. The head is rounded, very abruptly declivous anteriorly, and its surface a little roughened. The eyes are prominent.

The first thoracic segment is a little longer than any of those which follow, and the last three are each provided with a row of tubercles on their posterior borders; these become more numerous and spiniform on the last. The epimeral plates of all the thoracic segments except the last are truncated behind and are vertical in direction.

The abdomen is covered with large tubercles, the posterior portion descending abruptly behind to near the margin, which is slightly produced, while its upper surface has a median shallow depression. On the inferior view the abdomen shows a narrow V-shape, being produced to a triangular point at the exit of the channel, which is moderately deep; on each side of the median one there are three other small projections or teeth, thus showing six small notches on the posterior border.

The surface of the basal joints of the antennules are on the same level as the surface of the head, the rostrum meeting the epistome in a broadly truncate manner. The epistome is small, the upper lip long.

The first antennular joint is not produced distally at either angle, the third joint is about twice as long as the second, the flagellum is shorter than the peduncle, and has 8 joints.

The antenna is slightly shorter than the antennule, and its very short flagellum has only 5 or 6 joints.

The mandibles are strong and project much.

The legs are robust, with rather short dactyli, except for a longish nail, and they are without the furry pads noticed in other species.

The first pleopods have the inner ramus short, about as broad at its base as its length; the inner margin with short

fine hairs, the outer margin slightly insinuate; the outer ramus longer than the inner, showing areolate structure. The second pleopods have the appendix longer than the lamina of the inner ramus. The inner ramus of the third pleopods is opaque and distally truncated; the outer ramus with a division rather distant from the end, terminating in a small notch on the inner margin. The outer ramus of the fifth pleopods is narrow, with a distal thickening obscurely three-lobed, with a small lobe, perhaps double, on the inner margin just below. The division is indistinct.

The uropods project obliquely downwards, the external ramus is sublaminate, bifid at the extremity, the outer margin cut with four teeth, the inner with one. The inner ramus also is bifid and much reduced.

Integument hard.

The female is unknown.

Gulf St. Vincent. One specimen.

Cilicæa tridens, n. sp. Pl. xxiii., figs. 1 to 12.

The body is very convex, with nearly parallel sides, slightly setose, and nodular to rugged on the abdomen.

The head is nearly vertical anteriorly, and very nodular; some of the tubercles inclined to be spiniform. There is a much-thickened anterior border projecting, and there is a median rounded tubercle just above the rostral process and a thickening above each antennule. The rostral process is truncated, and does not project. Looked at from below the epistome recedes towards the rostrum anteriorly, and at the angle where it meets the apex of the labrum it slightly projects.

The eyes are rounded and prominent.

The first segment of the thorax is also nodular; its posterior lateral angle is truncated and little produced backwards. Each of the remaining thoracic segments bears a row of strong spines on its posterior margin, especially the seventh. The epimera have each a nodule, and they are vertical in direction; those of the third and seventh segments are shorter than the others. A suture line is evident.

The abdomen is very tuberculate and jagged. The anterior portion projects behind as a trident, the median process of which is slightly bent downwards and slightly overreaches the end of the abdomen; also, this part of the abdomen projects downwards laterally a good deal. The posterior portion has three conspicuous tubercles on each side of the median process of the anterior portion, and behind these the descent is abrupt and excavate medianly with three prominent tubercles on each side, arranged triangularly two

above and one below : in the immediate region of the posterior border the surface is oblique. The posterior notch is deep; the median process does not reach the lateral projections. These are acute, and have an oblique direction, while the median process is more horizontal in direction. Another small acute projection is higher up on each side, and higher still a third on each side is faintly indicated; thus there are six notches corresponding in a degree with those of the preceding species.

The first antennular joint is rather short, convex externally, not distally notched; but the posterior angle is subacute and projects slightly. The second joint is about half as long as the first, the third joint is longer than the second, and the flagellum has 10 joints.

The last joint of the peduncle of the antenna is longer than the one preceding it; its flagellum also has 10 joints.

The mandibles have the incisory processes oblique and entire. A secondary plate on the left mandible is also nearly entire; spine rows and molars are well developed.

Maxillæ strongly spined.

The legs are provided with spines, and the furry pads are absent. In the first gnathopods, which are more robust, the anterior side of the ischium projects as a prominent angle about the middle; the dactylus is large, and about as long as the propodus.

The sternal filaments are rather long.

The external ramus of the fifth pleopod has a distal thickening, which probably represents two lobes, and one on the inner margin distally from the division line, with one on the proximal part just below this. Below this is another slight lobe, some distance down. The outer margin bears small setæ.

The external ramus of the uropods is smaller than the inner; it has an oblique upward direction, and is apically acute. There is an acute process on the inner side, another on the upper surface near the outer angle, and a small one on the outer angle itself. The inner ramus has a strong obtuse projection on the outer side, with another one behind it, and one on the inner side; the apex is obtuse.

The specimen I take to be the female of this species is much less nodular. The median process of the posterior notch of the abdomen projects considerably as a slightly tridentate process. The channel is deep. There are no rows of spines on the thoracic segments, and the anterior portion of the abdomen has no process.

The mouth parts are modified.

Gulf St. Vincent. Two male and one female specimens.

Genus *Zuzara*, Leach.

Sp. **Zuzara venosa,** Stebbing. Pl. xxiii., figs. 13 to 16; Pl. xxiv., figs. 1 to 3.

Cycloidura venosa, Stebbing, Jour. Linn. Soc., vol. xii., 1876, p. 146, pl. vi.

Zuzara integra, Haswell, Proc. Linn. Soc., N.S.W., vi., 1881-2, pp. 186-188, pl. iii., fig. 6.

Zuzara integra, Richardson, Proc. U.S. Nat. Mus., vol. xxxi., p. 12.

The body is minutely granulate and pubescent.

The eyes are large.

The rostral process of the head is rather acute, and has a slight median elevation.

The epistome has an arcuate crest, and a triangular area on a different plane occupies the space between it and the rostrum. The lateral limbs of the epistome thin away and recede; below the crest the surface is rather excavated.

The epimeral plates of the thoracic segments, except the first, are marked by suture lines, and project a little laterally before taking a vertical direction, then the ends are a little turned outward again, the second, third, fourth, and fifth with points a little produced backwards also.

The process of the seventh thoracic segment is sometimes nearly truncate, in other specimens abruptly narrowed to a small obtuse point. In some males there is a small tubercle on the posterior edge on each side of this process.

The after - portion of the abdomen has a very shallow longitudinal median depression, and it is more granulate than other parts of the body. The terminal process is dorsally raised and keel-like, with a hump. The under side of this process has also a narrow longitudinal keel, and immediately in front of it is a slight excavation, apart from the general excavation of the abdomen.

A small group of five or six long setæ springs from the outer side of the mandible close by the molar process.

The legs are very furry on the usual joints.

The upper surface of the external ramus of the uropod is excavated for nearly the whole of its length, having a raised and thickened external border; it is produced much beyond the end of the abdomen. The venation of the uropods is seen in the females and young males, but is obscured in adult males. The inner margin of the inner ramus is slightly bent, to conform to the indentation at the side of the terminal process of the abdomen.

The adult female is quite without process to the seventh segment of the thorax, and there are two faint median tubercles on the posterior portion of the abdomen.

A crest on the epistome is nearly obsolete in some female specimens

The mouth parts are unmodified, and the marsupial plates are not overlapping in mature females, as observed by Dr Hansen

I have always found specimens bearing any indication of a median process on the seventh thoracic segment, as also rudimentary narrowing of the posterior extremity of the abdomen, to be immature males

Gulf St. Vincent. One of our commonest marine isopods littoral species.

Zuzara (Isocladus) excavata, n. sp Pl. xxiv , figs. 4 to 6.

This closely-allied species has the body almost completely glabrous.

The segments of the thorax differ little in length, except the seventh ; seventh segment with a process reaching as far as the end of the abdomen, abruptly contracted to a small obtuse point at the distal end.

The anterior portion of the abdomen is short, the posterior portion triangular in shape, and towards the end again slightly contracted, ending in an obtusely-rounded point; the inferior surface of this is slightly excavated, as in the preceding species.

The anterior part of the epistome is not crested, but the surface gradually curves over to the rostrum; the lateral limbs thin away and recede more than in *Z. venosa.*

The antennular flagellum has 12 joints, the basal joint with uneven surface. The antennal flagellum has 15 joints.

The mandibles have the incisory plates entire, the secondary plate absent from the left mandible.

The uropods are broad and lamellate, with the venation more evident than in *Z. venosa.*

The female of this species has not been recognized.

Gulf St. Vincent, littoral. One specimen.

Zuzara (Exosphæroma) lævis, n sp Pl. xxiv., figs. 7 and 8.

Body smooth and glabrous.

Eyes large and prominent.

Thorax not expanding so much posteriorly as in the two preceding specimens.

First segment of the thorax shorter than the head, and only slightly longer than those which follow. The seventh segment is without process.

The anterior abdominal segment is short and acutely angular at the sides. The posterior segment is triangular,

not specially contracted at the end, which is acute and slightly bent downwards.

The epistome is without anterior crest; the sides thin away and recede more than in the two preceding species.

The antennules have the flagellum with 10 joints, that of the antenna with 16 joints.

The mandibles have the group of setæ near the molar process, as in *Z. venosa* and *Z. excavata*.

The mouth parts, legs, and pleopods resemble those of the preceding species. The *appendix masculina* is long; its apex bears a few setules.

The uropods are broad and lamellar, the inner ramus not reaching quite to the end of the abdomen, the outer one a little beyond.

A young male, apparently of this species, has the end of the abdomen much more rounded, the uropods not reaching as far as it.

Females of this species I have not observed.

Gulf St. Vincent. Two adult male and one young male specimens.

Group EUBRANCHIATÆ, Hansen.

Genus *Cerceis*, M. Edw.

Cerceis trispinosa, Haswell. Pl xxiv, figs 9 to 15.

Cymodocea trispinosa, Haswell, Proc. Linn. Soc., N.S.W., vi., p. 189, pl. iii., fig. 7.

The body of the male has the usual shape of species of this genus. The head is gradually declivous anteriorly without a distinct transverse ridge. The rostral process is well marked, and not fused with the epistome.

The segments of the thorax do not differ much in length; their epimeral plates are large, and are marked off from their respective segments by a faint longitudinal groove. That of the seventh is hooked behind.

The anterior portion of the abdomen is short, and has a small median tubercle on its posterior border. There are also besides the median larger tubercle of the posterior portion two smaller tubercles side by side just above it; this portion is sparingly granular and setose. The posterior notch is deeply cut, narrow, and as its median process is only slightly raised above the lateral processes the channel below is not very deep.

The epistome is broad, apically acute, its lateral limbs much spread out, their extremities each with two small tubercles: there is also a small tubercle at the base of each limb The labrum is rather large. The basal joint of the antennule is deeply notched, its distal anterior limb is

hooked, and the posterior one reaches nearly to the end of the second joint. The flagellum has 19 short joints.

The flagellum of the antenna has 20 joints.

The legs are uniform, with furry pads on the usual joints.

The sternal filaments are short.

The first pleopods are short and broad, the outer ramus has few or no teeth—apart from the slight elevations which carry the setæ—and there are few setules, as observed in other species; there is a ridge near the inner margin. The inner ramus is much broader than long, and is also without marginal teeth. The outer ramus of the second pleopods has several marginal teeth and setules, which arise in the intervals between the plumose setæ. The *appendix masculina* arises, as in other members of this genus, about half-way along the inner margin of the inner ramus. The outer ramus of the fifth pleopod has the division quite near the end, the terminal lobes are well developed; there is also one on the inner margin, which is smaller, longer, and narrower than usual. The external margin bears fine hairs. Near the external margin of the outer ramus of the fourth pleopods there is a small conical process near the base, slightly serrate.

The external ramus of the uropod is large, acute, and slightly serrate on the external margin near the end; it reaches much beyond the inner ramus. The inner ramus reaches nearly to the abdominal notch, and is distally truncated, the inner angle being rounded, the outer acute.

The female of this species is smaller than the male. It is distinguished by its shape, and by having the median triangular tubercle of the after-part of the abdomen much larger than in the male; in having the outer ramus of the uropod only slighter longer than the inner ramus; the posterior notch of the abdomen is not so open and not so deeply cut into the margin, and the median process is more raised, making the narrow channel deeper. The epimera of the seventh thoracic segment is pointed behind, but not hooked. The anterior process of the antennular joint is long, but not quite so hooked. The female also has a larger number of teeth on the external rami of the first and second pleopods.

Several specimens from North Tasmania. Females probably not quite mature. Collected by Dr. Torr.

EXPLANATION OF PLATES.

Plate XXI.

Fig. 1. *Cymodoce tuberculosa*, Stebbing, side view of male, magnified 4½ diameters.

„ 2. „ „ posterior portion of abdomen of male.

Fig. 3. *Cymodoce tuberculosa*, antennule, antenna, epistome, etc., of mature female.
,, 4. ,, ,, antennular and epistomial teeth of male, showing depressed rostral teeth.
,, 5. ,, ,, right mandible of male.
,, 6. ,, ,, left mandible of male
,, 7. ,, ,, second maxilla of male.
,, 8. ,, ,, first maxilla of male.
,, 9. ,, ,, maxillipeds of male.
,, 10. ,, ,, first gnathopod of male.
,, 11. ,, ,, fifth pereiopod of male.
,, 12. ,, ,, second pleopod of male.
,, 13. ,, ,, exopod of fifth pleopod of male.
,, 14. ,, ,, posterior portion of abdomen of mature female.
,, 15. ,, ,, mandible of mature female.
,, 16. ,, ,, first maxilla of mature female.
,, 17. ,, ,, second maxilla of mature female.
,, 18. ,, ,, maxilliped of mature female.
,, 19. ,, ,, posterior portion of abdomen of immature male.
,, 20. ,, ,, immature male, magnified 4 diameters.
,, 21. ,, ,, n. var. *bispinosa*, posterior portion of abdomen of male.
,, 22. ,, ,, *bispinosa*, the same, superior view.
,, 23. ,, ,, ,, antennular, epistomial, and rostral teeth of male.

Plate XXII.

Fig. 1. *Cymodoce tuberculosa*, n. var., *bispinosa*, mature female, magnified 4 diameters.
,, 2 ,, ,, *bispinosa*, posterior portion of abdomen, mature female.
,, 3. ,, ,, ,, immature male, magnified 4½ diameters.
,, 4. ,, ,, ,, epistome of mature female.
,, 5. ,, ,, ,, posterior portion of abdomen of an immature male (another specimen). Compare pl. xxi., fig. 19.
,, 6. ,, ,, ,, posterior portion of abdomen of fig. 3.
,, 7. ,, ,, ,, antennule, antenna, epistome, etc., of fig. 3.
,, 8. ,, *septemdentata*, n. sp., male, magnified 4 diameters.
,, 9. ,, ,, male, magnified 4 diameters, side view.

Fig. 10. *Cymodoce septemdentata*, antennule, antenna, epistome, etc., of male.
,, 11. ,, ,, posterior portion of abdomen of male.
,, 12. ,, ,, first gnathopod of male.
,, 13. ,, ,, second gnathopod of male.
,, 14. ,, ,, fifth pereiopod of male.
,, 15. ,, ,, first pleopod of male.
,, 16. ,, ,, second pleopod of male.
,, 17. ,, ,, exopod of fifth pleopod of male.

PLATE XXIII.

Fig. 1. *Cilicæa tridens*, n. sp., male, magnified 5 diameters.
,, 2. ,, ,, posterior portion of abdomen of male.
,, 3. ,, ,, antennule, antenna, epistome, etc., of male.
,, 4. ,, ,, antennule, antenna, epistome, etc., of female.
,, 5. ,, ,, female, magnified 5 diameters.
,, 6. ,, ,, second gnathopod of male.
,, 7. ,, ,, first gnathopod of male.
,, 8. ,, ,, fifth pereiopod of male.
,, 9. ,, ,, maxilliped of male.
,, 10. ,, ,, first pleopod of male.
,, 11. ,, ,, exopod of fifth pleopod of male.
,, 12. ,, ,, second pleopod of male.
,, 13. *Zuzara venosa*, Stebbing, male, magnified 3½ diameters.
,, 14. ,, ,, right mandible.
,, 15. ,, ,, posterior portion of body of mature female.
,, 16. ,, ,, maxilliped of male.

PLATE XXIV.

Fig. 1. *Zuzara venosa*, posterior portion of abdomen and uropod of male.
,, 2. ,, ,, antennule, antenna, epistome, etc., of male.
,, 3. ,, ,, exopod of fifth pleopod of male.
,, 4. ,, *(Isocladus) excavata*, n. sp., male, magnified 4½ diameters.
,, 5. ,, ,, ,, epistome of male.
,, 6. ,, ,, ,, posterior portion of abdomen of male.
,, 7. ,, *(Exosphæroma) lævis*, n. sp., male, magnified 4 diameters.
,, 8. ,, ,, ,, antennule, antenna, epistome, etc., of male.
,, 9. *Cerceis trispinosa*, Haswell, male, magnified 2½ diameters.
,, 10. ,, ,, female, magnified 3 diameters.
,, 11. ,, ,, antennule, antenna, epistome, etc., of male.
,, 12. ,, ,, first pleopod of male.
,, 13. ,, ,, posterior portion of abdomen of male.
,, 14. ,, ,, portion of exopod of fifth pleopod of male.
,, 15. ,, ,, second pleopod of male.

THE BRACHIOPODS OF SOUTH AUSTRALIA.

By Jos. C. Verco, M.D. (Lond.), F.R.C.S. (Eng.), etc.

[Read April 5, 1910.]

Plates XXVII. and XXVIII.

In November, 1906, Professor F. Blochmann, of the Zoological Institute of the University of Tubingen, wrote to Professor Stirling, Director of the Adelaide Museum, requesting the loan of its Brachiopod material, so as to permit of his investigating the South Australian forms. He was working up the Brachiopods of the Valdivia and Gauss Expedition, and had been led into some important questions concerning the geographical distribution of the members of this group. As the Museum material was meagre, Professor Stirling passed the letter on to me, and I sent Professor Blochmann all our well-known forms, and as many other species as I had then separated, from the shells dredged during several years.

In the early part of this year he forwarded a communication to be used at my discretion, either as a paper by Professor Blochmann, presented by me, to be published in the Transactions of the Royal Society of South Australia, or as material for me to use in compiling a paper of my own. To combine the two ideas seemed the proper course, and with the acquiescence of the Council I present a paper on the Brachiopods of South Australia, which will deal with all the species hitherto found in our waters, and will incorporate Professor Blochmann's descriptions of his three new species, translated from his manuscript, and attributed, as they should be, to him as their author. We are indebted to him for the photographs of his three species. My remaining material has supplied two other new species, which I have described and figured.

The late Professor Tate, in a Revision of the Recent Lamellibranch and Palliobranch Mollusca of South Australia, Trans. Roy. Soc. of S. Austr., vol. ix., 1886, p. 76 to p. 111, enumerated five Brachiopods, namely, *Waldheimia flavescens*, Lamarck, now called *Magellania flavescens; Terebratella cancellata*, Koch, now *Terebratulina cancellata; Megerlia willemoesi*, Davidson, which was a misidentification, and is the *Magasella vercoi*, Blochmann, n. sp.; *Kraussina lamarckiana*, Davidson, which remains unaltered; and

Orbicula tenuis, Sowerby, reported from Chili and Port Lincoln: this latter locality is certainly erroneous, no collector having taken it, so it is erased from our list.

In vol. xi., *op. cit.*, 1888, p. 69, Professor Tate added *Magasella cumingi*, Davidson; and in vol. xiv., 1891, p. 269, *Terebratula wyvillei*, Davidson, dredged by the "Challenger" in lat. 42° 22′, which is a considerable distance off our shores. This is now named *Liothyris wyvillei*.

To the five species, belonging to five different genera above recorded by Professor Tate, we are able to add in this paper two previously-described species, *viz.*, *Kraussina atkinsoni*, Tenison-Woods, and *Cryptopora brazieri*, Crane; and five species hitherto undescribed, *viz.*, *Magasella vercoi* and *M. jaffaensis* and *Cistella australis*, all of Blochmann; and *Magasella radiata* and *Terebratulina cavata*, both of Verco, bringing our number up to twelve species belonging to seven genera.

NEW BRACHIOPODS FROM SOUTH AUSTRALIA.

By F. Blochmann, Tubingen.

Dr. Verco, of Adelaide, had the kindness to place in my hands a large number of Brachiopods for classification which he had collected off the coast of South Australia. For this I tender him my best thanks. The material embraced, besides well-known species from these waters, such as *Magellania flavescens*, *Magasella cumingi* and *Kraussina lamarckiana*, two *Magasellas* and one *Cistella*. About the first two, Dr. Verco properly presumed that they were forms hitherto unknown; the last he believed was *Cistella cuneata*, which from want of material for comparison is easily explicable. This species is also new. I give below an accurate description of the three species, and remark as follows:—Some authors question whether Brachiopods of the type of *Magasella* are independent forms, and are only immature stages of *Terebratella*—even though becoming sexually mature—but I hold this view is not correct in all cases. Among the examples of *Magasella vercoi* described hereafter, and also among the examples of *M. cumingi* sent to me by Dr. Verco are found, in considerable number, those which present all the marks of quite full-grown animals, especially a striking thickening of the shells in part, with loss of much of the more delicate sculpture; so that any further development of these forms is with certainty excluded. The genus *Magasella* is to be retained. I will return to this in fuller detail in another place.

Magasella vercoi, n. sp., Blochmann. Pl. xxvii., figs. 1 to 5.

Shell small, in outline of a slender pear shape, higher than wide, remarkably thickwalled, light to dark dull coral-red, with a conspicuous finger-shaped hinge process. The greatest width is somewhat in front of the centre. Beak stout, rather strongly bent dorsalwards, and then obliquely truncate, with a moderately large hole. Its sides are rounded, and towards the deltidial plate are finished off in a sharp edge. Deltidial plates large, joining together widely. Lateral edge of the ventral valve in the neighbourhood of the teeth raised dorsally in a low point, further forwards curving ventrally. Front edge distinctly convex dorsally.

Both valves are nearly equally deep. The accremental striæ are in both quite distinct. To the square millimetre there are about 216 pores, the inner diameter of which amounts to 20 μ. Their outer opening is oval, and measures 25-30 μ by 35-40 μ. Both valves are in their hinder part very massive. The thickness of the ventral valve at the beak amounts to about 0·6 mm. This circumstance, together with the somewhat thickened and in many examples distinctly contracted edge, shows with certainty that it has reached a full-grown stage. The colour is a dull lighter or darker coral-red.

The dorsal valve bears conspicuous tooth sockets, the free wall of which posteriorly projects over the hinge in a triangle. In front of the hinge lies a blunt finger-like hinge process. Under this, looking from the inner side, *i.e.*, also dorsal, appears a hinge-plate, depressed in a furrow-like manner in the middle. The hollow space generally existing between the hinge-plate and the wall of the valve is filled up. To the hinge-plate is joined on a stout median septum, reaching as far as the middle or even somewhat further forwards. Its free edge is strongly curved from before backwards, corresponding to the curve of the valve. The brachial apparatus begins with short crura, which bear wide triangular inconspicuous crural processes. The descending limbs reach the median septum widening towards the front, and descending ventrally unite widely with this, run a short distance backwards towards the hinge, and are then united by a bridge somewhat variable in width and position. The brachial apparatus is colourless, or very pale-red. The anterior portion of this is in its general form somewhat variable.

Dim.—The size of the largest example before me and of another is:—

Length, 7·5 mm. and 6·5 mm.
Breadth, 4·0 mm. and 3·7 mm.
Thickness, 4·8 mm. and. 4·4 mm.

Locality.—Backstairs Passage, near Adelaide, South Australia (Dr. Verco's Coll.).

Magasella jaffaensis, n. sp., Blochmann. Pl. xxvii, figs. 6 to 9.

Shell in outline almost circular (fig. 6), or from the middle forwards somewhat narrowed (fig. 8), both valves approximately equally deep and equally curved. Commisures in one plane. Growth striæ, in places distinct or obsolete. Beak short, wide, with moderately sharply-defined edges. Deltidial plates large, joined together. Hole small.

Number of pores, 170-230. Of three examples, one (fig. 8) has the higher number, 212-228; both the others, 170-212. Diameter of the round inner opening of the pores, 20-23 μ; of the outer oval opening, 50 by 30 μ. Colour of the shells found dead, but well preserved, a dirty white.

The dorsal valve has a moderately-developed hinge process, and large tooth sockets with comparatively feeble walls. Between these lies a slightly undermined hinge-plate, sunken towards the middle, which extending as a narrow triangle passes over into the strong median septum. This ends abruptly behind the middle with a slightly curved edge. In the posterior half of its course it remains low, in the anterior it rises to a flat surface twice as high as the hinder portion, which on its ventrally-directed border is split in a furrow-like manner. From the wall of the tooth sockets spring short strong crura, with large slender pointed crural processes. The descending limbs widen rapidly towards the front, and are applied to the anterior elevated part of the septum, so that the edge of the limb, at first dorsal, then directed centrally, approximately strikes upon the middle of this elevated part of the septum. Towards the front they reach far over beyond the front edge of the septum. This strong widened part of the limb coalesces with the septum, so that it does not project forwards over it, then runs narrowing towards the border of the hinge and laterally, bends, still further narrowing, medially again, whereby the two limbs are united by means of a moderately wide bridge. A few small prickles occur at the free anterior border of the part uniting the ascending and descending branch of the limbs. The dorsal and ventral valves are in the posterior part moderately thick; this indicates that the examples are almost or quite mature.

Dim.—Size of the largest example: Length, 14·6 mm.; width, 13·5 mm.; thickness, 8 mm.

Locality.—Cape Jaffa, South Australia, 90 fathoms.

The form has been closely compared with examples of *Magellania flavescens* of the same size, and is immediately distinguished from them by its general shape, and especially by the very differently-shaped beak, and by the complete absence of ribs, which are already quite plain in really small examples of *M. flavescens*. Again, in the formation of the brachial apparatus distinct differences present themselves. By the general form, one might be reminded of young examples of *M. lenticularis* (the illustration of Davidson, Recent Brachiopoda, pl. ix., figs. 2 to 13), although this is not yet known from the Australian coast. But against this likeness are the much more strongly hook-shaped curved beak in the last-named form, the very small diameter of the inner orifices of the pores (scarcely 10 μ), and the quite distinct pattern on the valves. Also, the brachial apparatus of the young figured example of Davidson is quite different. So it remains only to regard the examples before us as representatives of an independent new species.

Cistella australis, n. sp., Blochmann. Pl. xxvii., figs 10 to 12.

Shell as long as broad. Colour dirty-yellow.

Length and breadth are equal, thickness amounts to about one-half of this. Because the dorsal valve is bounded behind by a straight hinge-line, it approaches a semicircle in outline. The complete outline is altered by the triangular beak. The end of the beak is flatly rounded. Its edges are sharp. Between them and the hinge-line is a flat area. Deltidial plates seem wanting. The hole of the beak is large, bounded towards the front to a considerable extent by the hinge-margin of the dorsal valve.

Each valve bears a moderately conspicuous median sinus, and on each side of this three ribs, increasing rapidly in width towards the periphery. These project at the edge as rounded teeth, so that if the posterior corner is included, four rounded teeth are found at the edge, on each side of the notch corresponding to the median sinus. These are not always quite distinct, so that the edge often appears only flatly undulating. Also, variations occur between the right and the left. The growth striæ in both valves are quite distinct. Both valves are about equally deep. There are about 320 pores to the square millimetre; inner diameter of these, about 10 μ; outer diameter, about 15-20 μ; frequently oval, 20 μ by 10 μ.

The edge of the pedicle hole forms a conspicuous collar. In the ventral valve is found an indistinct median septum

extending to the anterior border. On the right and left of this septum lie deep and extensive muscular impressions. Teeth moderately developed. In the dorsal valve is also found a median septum, which in the posterior half is scarcely distinguishable, but in the anterior half rises as an obtuse triangular process, reaching almost to the ventral valve. The tooth sockets are well developed. At their wall begins the brachial apparatus, the crural processes of which are moderately long and slightly pointed. After a short free course, nearly parallel with the inner surface of the valve, the limbs are applied to the inner surface of the valve, and then cease. Also from the median septum there stretches on either side to the inner surface of the valve a short little band, the ideal continuation of the hinder part of the limb.

Dim.—Size of the largest example: Length, 3 mm.; width, 3mm.; thickness, 1·3 mm.

Locality.—Cape Willoughby, eastern end of Kangaroo Island (Dr. Verco's Coll.).

Cryptopora brazieri, Crane.

Atretia brazieri, Davidson, MS., Crane, Proc. Zool. Soc., Lond., 1886, p. 183; also, *op. cit.*, Dr. T. Davidson on Recent Brachiopoda, Appendix, p. 175, pl. xxv., figs. 16-17*a*. *Type locality*—Port Stephens, New South Wales, at 25 fathoms (J. Brazier).

Cryptopora brazieri, Crane; Hedley, Proc. Linn. Soc., New South Wales, 1906, vol. xxxi., part 3, p. 467, pl. xxxvi., figs. 1 and 2. Common at 17-20 fathoms around Masthead Island, Queensland.

Dredged at 6 fathoms, off St. Francis Island, 2 alive; at 40 fathoms, off Beachport, 2 good; at 49 fathoms, off Cape Jaffa, 1 perfect; at 62 fathoms, off Cape Borda, 27 perfect; at 90 fathoms, off Cape Jaffa, large numbers; at 104 fathoms, 35 miles south-west of Neptune Islands, 20 perfect; at 110 fathoms, off Beachport, 10 perfect; at 130 fathoms, off Cape Jaffa, 5 moderate; at 150 fathoms, off Beachport, 2 dead; at 300 fathoms, off Cape Jaffa, 4 dead. Its habitat in our waters seems to be at a depth of 60 to 110 fathoms. I have never taken it at so low a depth as 20 fathoms, that at which Mr. Hedley secured it in Queensland.

Liothyris wyvillei, Davidson.

Terebratula wyvilli, Davidson, Proc. Roy. Soc., Lond., vol. xxviii., p. 436, 1878; also "Challenger" Rep. Zool., vol. I., 1880, p. 27, pl. ii., figs. 7 and 8.

Liothyris wyvilli, Davidson, Proc. Linn. Soc., Lond., 1886, p. 15, pl. ii., figs. 8-14. *Type locality*—Off South Australia, in lat. 42° 42′ S., long. 134° 10′ E.; depth, 2,600 fathoms. Also off the coasts of Chili, Patagonia, and the Falkland Islands.

Terebratulina cancellata, Koch.

Terebratula cancellata, Koch, in Küster, Conch.-Cab., 1843, Band vii., Abt. i., p. 35, pl. 2b, figs. 11-13. *Type locality*—Western Australia; Sowerby, Thes. Conch., 1846, p. 358, pl. lxxi., figs. 93-95, no locality cited

Terebratula (Terebratulina) cancellata, Reeve, Conch. Icon., 1860, pl. iv., fig 13.

Terebratulina cancellata, Dall., Proc. Acad. Nat. Sci, Philadelphia, 1873, p. 179. Davidson, "Challenger" Rep. Zool, 1880, vol. i., p. 37, pl. i., figs. 11-16, 35 to 40 fathoms, Bass Strait; also, Trans. Linn. Soc., Lond., 1886, Recent Brachiopoda, p. 35, pl. vi., figs. 1-8; Hedley, Memoirs Austr. Mus., 1902, vol. iv., p. 288, 50 to 60 fathoms, off Jibbon; Hedley and May, Records Austr. Mus., 1908, vol. vii, No 2, p. 114, 100 fathoms, off Cape Pillar, Tasmania.

Dredged alive at 15 fathoms in Backstairs Passage, 4; at 16, 17, 18, 20, and 22 fathoms, very many; at 30 fathoms, off Corney Point, Spencer Gulf, 17; at 40 fathoms, off Beachport, 3 alive and 11 dead, all small; at 55 fathoms, off Cape Borda, 1 alive 11 dead, all small, and at 60 fathoms, 10 dead, small; at 90 fathoms, off Cape Jaffa, 2 minute, dead; at 110 fathoms, off Beachport, 4 minute and 13 small, dead, and at 150 fathoms, 3 minute. It occurs in both our gulfs and both straits, and has its habitat from 15 to 30 fathoms. It may occur in shallower waters (in which I have dredged very seldom), as it has been taken in Port Jackson by Brazier in 3 and 7 fathoms. The "Challenger" took it abundantly in 35 to 40 fathoms. Beyond that depth only very immature specimens have been obtained by me.

Terebratulina cavata, n. sp., Verco. Pl. xxviii., figs. 1 to 5.

Shell thin-walled, translucent, oval, widest a little in front of the middle. Ventral valve very little deeper than the dorsal, convex longitudinally, especially towards the beak, transversely convex, slightly centrally flattened; lateral edges slightly concave, front slightly convex. Beak very short, obliquely truncated. Foramen of moderate size, incomplete, the anterior eighth formed by the back of the dorsal valve, bevelled from the outer to the inner edge. Deltidial plates narrow triangular, not meeting in the middle line. Teeth small, projecting inwards and backwards. Dorsal valve convex longitudinally and transversely, slightly prominent centrally, and sloping at the sides; lateral edges convex, anterior edge slightly concave. Hinge line narrow and straight. Tooth sockets well developed, excurved, and pointed ventrally. Crura rather short and stout. Loop annular, completed by a ventrally convex ventral crural

band; the side pieces are shallow and project obliquely forward; the dorsal band is longitudinally wide, concave dorsally, projecting well in advance of the ventral band, and with a deep, nearly square, sinus in its posterior edge (whence the specific name).

Sculpture.—Longitudinal ribs, about 12 at first, flatly triangular, crenulating the edge of the foramen, and increasing by trichotomous division. Growth lines scarcely visible: some irregularly-distant concentric shallow grooves.

Dim.—Length, 16·25 mm.; width, 11·5 mm.; depth, 7 mm. The largest is 14 mm. wide. Another is 17·5 mm by 12·25 mm.

Locality.—Type locality, at 130 fathoms, off Cape Jaffa, 37 examples, all dead (7 probably nearly or quite full grown, 5 small, and 25 very small); also, at 300 fathoms, 4 mature, 13 small, and 76 very small.

Diagnosis.—*T. cancellata*, Koch, is closely allied, but is flatter, has more numerous, rounder, rougher riblets arising by irrégular intercalation; its loop is wider, and has narrower bands, and the dorsal bridge has posteriorly a blunt central projection instead of a sinus.

Magellania flavescens, Lamarck.

Terebratula flavescens, Lamarck, Anim. S. Vert., vol. iv., 1819, p. 246, also vol. vii., 1836, p. 330. *Type locality*—The seas of India to Java Conch.-Cab., Band vii., Abt. i., p. 45, sp. 27, pl. 2*d*, fig. 4.

Terebratula australis, Quoy and Gaimard, Voy. de l'Astr., 1834, Moll., vol. v., p. 551, pl. lxxxv., figs 1-5, Port Western, Vict.; Sowerby, Thes. Conch., 1847, p. 349, sp. 13, pl. lxix., figs. 25-33.

Terebratula dentata, Lamarck, Anim. S. Vert., 1836, vol. vii., p. 331. *Type locality*—The southern seas (?), Peron.

Terebratula incurva, Quoy and Gaimard, *loc. cit.*, p. 554, pl. lxxxix., figs. 11 and 12.

Waldheimia flavescens, Lamarck, Reeve, Conch. Icon., 1860, pl. 1 and 2, figs. 1*a*, *b*; Tenison-Woods, Proc. Roy. Soc., Tasm., 1878 (1877), p. 57, north coast of Tasmania; Davidson, "Challenger" Rep. Zool., vol. i., 1880, p. 41, pl. iii., figs. 10-12; also, Proc. Linn. Soc., Lond., vol. iv., 1886, p. 41, pl. vii., figs. 6-19; Hedley, Memoirs Austr. Mus., vol. iv., 1902, p. 289, 11 to 15 fathoms, off the Crookhaven River.

Magellania flavescens, Lamarck, Tate and May, Proc. Linn. Soc., New South Wales, vol. xxvi., 1901, p. 441.

Found all along the South Australian coast, as far as Point Sinclair. Dredged alive at all depths from 6 to 30 fathoms in numbers; at 40 fathoms, off Beachport, 10, from very minute to 1 quarter-grown; and at 100 fathoms, 19 minute, alive.

Magasella cumingi, Davidson.

Terebratella (?) cumingii, Davidson, Ann. and Mag., Nat. Hist. 1852, 2nd ser., vol. ix., p. 368, and Proc. Zool. Soc., Lond., 1852, p. 78, pl. xiv., figs. 10-16.

Terebratula (Bouchardia) cumingii, Reeve, Conch. Icon., 1861, pl. viii., fig. 30.

Magasella cumingii, Davidson, "Challenger" Rep. Zool., vol. i., 1880, p. 48.

M. cumingi, Davidson, Proc. Zool. Soc., Lond., 1886, p. 97, sp. 54, pl. xvii., figs. 23-32.

Magas cumingi, Davidson, Angas, Proc. Zool. Soc., Lond., 1867, p. 935, "deep water outside Port Jackson Heads."

Terebratula (Bouchardia) fibula, Reeve, Conch. Icon., 1861, pl. viii., fig. 30.

Dredged in both gulfs and both straits at 12 fathoms, 75 alive; at 13 fathoms, 6 alive; at 15 fathoms, 51 alive; at 17 fathoms, 83 alive; at 20 fathoms, very many; at 22 fathoms, great numbers; at 27 fathoms, 2 alive; at 30 fathoms, several dead; at 35 fathoms, off St. Francis Island, 2 alive; at 40 fathoms, off Beachport, 15 small, dead; and at 49 fathoms, 24 small, dead; at 55 fathoms, off Cape Borda, 7 small, dead; and at 62 fathoms, 27 small, dead; at 90 fathoms, Cape Jaffa, 10 minute; at 110 fathoms, Beachport, 20 perfect (several alive up to full-grown); at 130 fathoms, Cape Jaffa, 26 minute and up to adult; at 150 fathoms, Beachport, 19 perfect, small, and 15 valves; and at 200 fathoms, 7 dead, very poor.

Magasella exarata, n. sp, Verco. Pl. xxviii., figs. 6 to 8.

Shell small, solid, oval, compressed dorso-ventrally, white. Dorsal valve nearly flat, with a shallow median furrow widening anteriorly; slightly convex longitudinally and transversely: lateral margin sinuous, convexo-concave from behind, and convex in front to correspond with the median sinus. Ventral valve twice as deep as the dorsal, uniformly convex longitudinally. Beak projecting considerably beyond the hinge line, solid, slightly curved dorsally. Foramen triangular, completed in front by the dorsal valve, rounded behind, and not extending to the end of the beak; bounded at the sides by a solid, stout, low lamina. Sculpture, numerous axial diverging riblets, increasing by intercalation, with concentric riblets, somewhat irregular in size and distance. Border internally plicately toothed. The hinge teeth in the ventral valve are very low and small and tubercle-like. In the dorsal valve the laminæ on the inside of the tooth sockets are prominent and solid. From the anterior end of their bases two short stout processes project forwards ventrally, and converge without uniting. Two

low ridges also extend forwards on the wall of the valve from the bases of the laminæ, and unite just in front of its centre, and continue as an obsolete ridge to the front margin.

Dim.—Length, 7·75 mm.; width, 5·5 mm.; depth, 2 mm.

Diagnosis.—*M. cumingi*, Davidson, is smooth, without external sculpture, and has a fine foramen at the end of the beak.

Locality.—Type, at 150 fathoms, off Beachport, with 1 other good and 1 of a narrower form; also, at 40 fathoms, 2 good, and at 110 fathoms, 1 good and 1 valve; at 49 fathoms, off Cape Jaffa, 1 small.

Magasella vercoi, Blochmann, *antea*.

I may add to the locality given by the author.

Dredged in Backstairs Passage, at 16 to 18 fathoms, 15 alive, many dead; at 19 fathoms, a great many alive and dead, probably 200; at 20 fathoms and at 22 fathoms, very many; at 40 fathoms, off Beachport, 2 good and 3 moderate; at 62 fathoms, off Cape Borda, 2 poor; at 110 fathoms, off Beachport, 3 good and 9 moderate; at 130 fathoms, off Cape Jaffa, 2 poor, 21 poor and rolled; at 150 fathoms, off Beachport, 2 good, quite white; and at 200 fathoms, 2 valves, poor.

Its habitat seems to be just about Backstairs Passage from 15 to 22 fathoms, beyond which it is rare and dead.

This is the shell which Tate recorded as *Megerlia willemoesi*, Davidson, from 22 fathoms, in Encounter Bay (R. H. Pulleine), in Trans. Roy. Soc. of S. Austr., vol. ix., 1886, p. 110.

Magasella jaffaensis, Blochmann, *antea*.

I may add to the locality given by the author.

Dredged, all dead, off Cape Jaffa, at 90 fathoms, 35 large and small, and 24 very small; at 130 fathoms, 17 moderate size, 2 small; at 300 fathoms, 16 good, very small, and 6 very poor; at 110 fathoms, off Beachport, 4 good; at 150 fathoms, 8 moderate; at 200 fathoms, 8 moderate, 1 good, and 6 valves.

Kraussina (Megerlina) lamarckiana, Davidson.

Kraussia lamarckiana, Davidson, Proc. Roy. Soc., Lond., 1852, p. 80, pl. xiv., figs. 22 and 23. *Type locality*—Sydney. H. and A. Adams, The Genera of Recent Mollusca, vol. ii., p. 579, 1858.

Terebratula (Kraussia) lamarckiana, Davidson; Reeve, Conch. Icon., pl. ix., fig. 34, 1861.

Kraussina lamarckiana, Davidson; Chenu, Man. de Conch., 1862, vol. ii., p. 206, fig. 1057; Tenison-Woods, Proc. Roy. Soc., Tasm., 1878 (1877), p. 57, Long Bay, Tasmania; Davidson, "Challenger" Rep. Zool., vol. i., 1880, p. 53, pl. iv., fig. 9.

Dredged alive off Cape Willoughby, Kangaroo Island, at 20 fathoms, 10 alive; at 17 fathoms, off Point Marsden, Kangaroo Island, 1 alive; at 62 fathoms, off Cape Borda, 1 dead; at 110 fathoms, off Beachport, 1 dead. Taken on the beach at Guichen, Holdfast, and Fowler Bays and on St. Francis Island.

Kraussina atkinsoni, Tenison-Woods.

Kraussia atkinsoni, Tenison-Woods, Proc. Roy. Soc., Tasm., 1878 (1877), p. 57. *Type locality*—Long Bay.

Kraussina, etc.; Davidson, Proc. Linn. Soc., Lond., 1887 (1886), p. 127, pl. xxi., figs. 5 and 6; Twelvetrees and Petterd, Proc. Roy. Soc., Tasm., 1900, p. 90, fig. 4; Tate and May, Proc. Linn. Soc., New South Wales, 1901, vol. xxvi., p. 442.

Taken on the beach at Robe, and at Venus Bay, rare.

Cistella australis, Blochmann, *antea*.

Dredged in 20 fathoms, off Cape Willoughby, Kangaroo Island, 7 alive.

EXPLANATION OF PLATES.

Plate XXVII.

Fig. 1. *Magasella vercoi*, Blochmann, side view.
,, 2. ,, ,, ,, dorsal view.
,, 3. ,, ,, ,, interior.
,, 4 ,, ,, ,, side view.
,, 5. ,, ,, ,, inclined side view of interior.
,, 6. *Magasella jaffaensis*, Blochmann, dorsal view.
,, 7. ,, ,, ,, side view.
,, 8. ,, ,, ,, dorsal view.
,, 9. ,, ,, ,, interior.
,, 10. *Cistella australis*, Blochmann, interior of ventral valve.
,, 11. ,, ,, ,, interior of dorsal valve.
,, 12. ,, ,, ,, dorsal view.
,, 13. ,, *cuneata*, Risso, interior, for comparison.

Plate XXVIII.

Fig. 1. *Terebratulina cavata*, Verco, ventral valve, interior.
,, 2. ,, ,, ,, dorsal valve, exterior.
,, 3. ,, ,, ,, ventral valve, side view.
,, 4. ,, ,, ,, dorsal valve, side view.
,, 5. ,, ,, ,, brachial apparatus.
,, 6. *Magasella exarata*, Verco, side view.
,, 7. ,, ,, ,, dorsal view.
,, 8. ,, ,, ,, brachial apparatus.

THE HÆMATOZOA OF AUSTRALIAN BIRDS. No 1.

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[Read October 4, 1910.]

PLATES XXV. AND XXVI.

It is proposed in the following paper, which we hope will form one of a series to be published from time to time, to deal with certain minute parasites found in the blood of Australian birds. In addition to descriptions of various species of these hæmatozoa which we have recently had under examination, we include a summary of the findings of previous workers in Australia in this field, and also give a list of our negative findings, which latter may prove of value in working out the intermediate hosts of some of the parasites, and in establishing the extent of the wanderings of individual birds of a species. It may be added further, that in no instance were the birds ruthlessly slain, but in every case skins were prepared, the body tissues and alimentary tract were searched for helminths, and the stomachs and crops were subjected to careful examination to ascertain the exact nature of the food. The information thus gained will appear, or has appeared, in appropriate quarters. It will thus be seen that every possible available use was made of the specimens secured.

THE HALTERIDIA OF AUSTRALIAN BIRDS.

In continuance of our descriptions of the blood-parasites of Australian birds, we have to record the presence of examples of the hæmosporidian genus *Halteridium* in additional species. Our detailed examination of these parasites from nine different kinds of Australian birds has led us to consider that more than one species of the parasite is present—a view we have given expression to in our earlier papers.[1 and 2] But, though we believe that with more complete studies of the life histories these differences will receive accentuation, we have found it often very difficult to describe such variations as are met with in our specimens in such a way as to differentiate one species

(1) Cleland and Johnston, Jour. Proc. Roy. Soc., N.S.W, xliii., 1909, pp. 75-96.

(2) Johnston and Cleland, Proc. Linn. Soc., N.S.W., xxxiv., 1909, pp. 503-7.

from another (if the differences are of specific rank), and these again from the descriptions of *H. danilewskyi* available to us.(3) This difficulty has been accentuated by reading various recent papers in which the writers describe *H. danilewskyi* as occurring in different birds, and sometimes hint that probably more than one species is incorporated under this name. We see only one way out of this difficulty, and that is to describe as fully as the material available will permit, the various parasites discovered in any particular bird.

Before passing on to describe the additional Halteridia we have found, we may first of all refer to some of the outstanding features of the first five forms we have described, the only Halteridia hitherto, we believe, found in Australian birds: —

H. meliornis (from *Meliornis novæ-hollandiæ*, Lath.) was specially noticeable for the number of small forms, sometimes as many as seven, in one red cell.

H. philemon (from *Tropidorhynchus corniculatus*, Lath., syn. *Philemon corniculatus*, Lath.) showed a protoplasm often highly granular.

H. geocichlæ (from *Oreocichla lunulata*, Lath., syn. *Geocichla lunulata)* presented special appearances in its gametocytes.

H. ptilotis (from *Ptilotis chrysops*, Lath.) did not present any special outstanding features.

H. nettii (from *Nettium castaneum*, Eyton) had remarkably large pigment masses, and was a very large parasite.

All these apparent differences may, it is true, only be stages in the life-history of one species of parasite.

Halteridium, sp. from Pomatorhinus superciliosus (Fam. *Timeliidæ*).

Plate xxv., figs. 1-5.

The bird, the victim of this parasite, was shot at Hallett Cove,(4) near Adelaide, in May, 1910, in company with several other birds which did not show the presence of hæmatozoa. Two further examples of this species of bird, shot at Tailem Bend, in South Australia (about 50 miles from the above locality), were not infected by it. The discovery of hæmatozoa in a South Australian bird is, we believe, now recorded for the first time.

(3) Cardamatis (Centr. f. Bakt., Orig., lii., 1909, pp. 351-368) gives a long list of European birds in which this parasite occurs.

(4) In the subcutaneous tissues of this bird a number of larval echinorhynchs were found.

The parasite itself is characterized by the large size of the halter-forms, which frequently occupy four-fifths or five-sixths of the available space in the red cells. It is also remarkable for the large size of the melanin granules in many specimens; these, though sometimes numerous and small, are at others remarkably large, and then appear sometimes as definite rods, sometimes as rounded masses.

The following is a description of ten consecutive parasites, afterwards arranged in order:—

(1). Pale, immature form, occupying only one end and side of the red cell. Melanin as small granules towards each end.

(2). Very pale-coloured. Occupies whole of red cell, except part of one side a little more extensive than length of nucleus. Host's nucleus a little displaced. Groups of large melanin granules at one end; six scattered fairly large granules at other; two near middle.

(3). Almost colourless. Extent and displacement of nucleus as in (2). Finely peppered throughout with rounded small melanin granules, often collected in little groups.

(4). Almost colourless. Extent and displacement of nucleus as in (2) and (3). Melanin as fairly large granules grouped at each end.

(5). Very pale. A little less extensive than (2), etc. Host's nucleus a little displaced. Medium-sized, rod-shaped granules, chiefly towards both ends and outer edge.

(6). Very pale. Extent and displacement as in (5). Pigment large, some masses very large; towards each end.

(7). Very pale. Parasite occupies whole of one end from level of nucleus, one side, and the longitudinal half of the other end. Nucleus not displaced. Pigment at both ends; very large at one end (9 masses), smaller at other (4).

(8). Pale-blue protoplasm. Occupies one side and part of ends. Very coarse large grains of pigment; two masses of several grains at one end, one in the middle, several scattered masses at other end.

(9). Pale-blue. Occupies nearly two-thirds of red cell. Host's nucleus a little displaced. Melanin as very large rod-shaped masses scattered generally.

(10.) Pale-blue. Occupies quite two-thirds of red cell. Nucleus a little displaced. Pigment as small masses in groups, chiefly at one end and middle, with small group at other end.

HALTERIDIUM, sp. from MYIAGRA NITIDA (Fam. *Muscicapidæ*).
Plate xxvi., figs. 1-5.

In an imperfectly-prepared blood-film from the Leaden Flycatcher, *Myiagra nitida*, shot at the Hawkesbury River in November, 1909, Halteridia were detected in the red cells.

The parasites possessed the typical form, and invested the host nucleus very closely, but did not displace it. Their size was about 0·01 mm. by 0·002 mm. They were thus much smaller than those seen in some other birds, *e.g.*, *Zosterops cærulescens*. The pigment was usually aggregated towards one end, but parasites were seen in which it was more dispersed. In all cases there were relatively few granules. No enlargement of the host cell was recognized.

HALTERIDIUM, sp. from an OWL, *Ninox boobook (?)*.
Plate xxvi., figs. 7-15.

In July, 1910, Dr. T. L. Bancroft, of Brisbane, kindly forwarded to us blood-films from an owl shot near Brisbane. These contained in relative abundance a Halteridium which, to our view, seems to differ from the other forms we have met with in Australian birds.

Male and female gametocytes were readily recognizable, and, in the accompanying descriptions of eight consecutive specimens examined, a re-arrangement has been made by which male forms are first taken, and female forms are concluded with:—

(1). Protoplasm pale-blue; nucleus pale-red, elongated; 14 scattered melanin granules.

(2). Parasite more towards one end of host cell; this end of parasite broader, other end narrowed; protoplasm pale-blue; nucleus pale-red, rather concentrated; 11 scattered melanin granules.

(3). Protoplasm pale; nucleus pinkish, elongated; 8 melanin grains towards one end, 1 at other, with another grain nearer centre, 2 opposite nucleus.

(4). Parasite towards one end of host cell; protoplasm pale; nucleus pinkish, elongated; 3 grains of melanin beyond centre at one end, 2 coarser grains towards other end, 2 coarse ones near centre.

(5). Parasite towards one end; nucleus pale-pink, elongated; 6 grains of melanin towards one end, 2 towards other end, 6 coarser ones opposite nucleus along outer edge.

(6). Protoplasm a little deeper blue; nucleus pale-pink, elongated; 2 masses of melanin towards one end, 4 towards other.

(7). Protoplasm like (6); nucleus pale-red, rounder; melanin as mass of several grains at one end, as 4 scattered grains at other, and as 2 scattered ones near nucleus.

(8). Protoplasm deep-blue, vacuolated; nucleus rounded, small, purplish.

HALTERIDIUM, sp from PTILOTIS PLUMULA, Gould (Fam. *Meliphagidæ*).

Plate xxvi., figs. 16-22.

Halteridia were found in a honey-eater, *Ptilotis plumula*, shot at Perth, Western Australia, in August, 1909. As far as we know, the finding of a blood parasite in native birds from that State is now recorded for the first time As the various European birds which have been introduced into the Eastern States of Australia (the sparrow, goldfinch, blackbird, starling, thrush, English skylark, etc.) do not so far exist in Western Australia, it shows that Halteridia were present in Australian birds before the introduction of species from elsewhere.

Most of the parasites were immature forms. In the only large halter form met with, the nucleus of the host cell was pushed a little aside. We can detect no definite differences (unless in a smaller amount of pigment) between this parasite and the Halteridium found in *Ptilotis chrysops* in Sydney district, though the two host birds are separated by a distance of about 2,000 miles.

The descriptions of nine successive specimens afterwards arranged in order are as follow:—

Host's red cells, $10{\cdot}5\ \mu. \times 5{\cdot}5\ \mu.$; nucleus, $7{\cdot}2\ \mu. \times 2\ \mu.$

(1). Very minute form; clear; as yet no pigment.

(2). Pale-coloured; $3{\cdot}6\ \mu.$ in size; three small melanin grains

(3). About same size as (2); at one end of host cell; no pigment.

(4). A little larger; at one end; small granule of melanin.

(5). At one end; $6{\cdot}3\ \mu.$ long; edge of parasite well defined, centre clear, 2 granules in centre.

(6). Half-grown; clear; small pigment granules along side towards host's nucleus and several in middle.

(7). Half-grown; pale; melanin along edge next host's nucleus (? artefact).

(8). Length of host's nucleus, but thinner; well stained; several melanin granules all at one end.

(9). Occupying more than three-fourths of red cell (whole of one side and both ends); nucleus of host pushed a little to one side; stains fairly well, finely granular; its nucleus not stained; melanin as one large and two smaller masses in centre.

HALTERIDIUM, sp. from MELITHREPTUS ATRICAPILLUS, Lath. (Syn. *M. lunulatus*, Shaw), (Fam. *Meliphagidæ*).

Plate xxv., figs. 6-10.

Halteridia were detected in films from a bird shot in the Sydney district in July, 1909. The parasites, though rather large, did not displace the host nucleus. Their protoplasm was very lightly stained, the nucleus when visible being a pale-pink (Giemsa). The latter was either a narrow elongate or a rounded structure, placed medianly or nearly so. Granules were rather small and numerous in the more deeply-staining parasites, while they were fewer and larger in the pale forms.

HALTERIDIUM, sp. from ZOSTEROPS CŒRULESCENS (Fam. *Zosteropidæ*).

Plate xxv., figs. 11-17.

The two birds harbouring this parasite were shot in February and in April, 1910, near Sydney. Blood-films from them were, unfortunately, ill-prepared, so that the structural peculiarities of the parasite were not readily distinguishable. The chief points noticed were its large size, occupying often five-sixths of the available space in the erythrocyte. The host cells themselves often showed definite enlargement with distinct displacement of the nucleus.

THE TRYPANOSOMES OF AUSTRALIAN BIRDS.

TRYPANOSOMA ANELLOBIÆ, n. sp. from ANELLOBIA CHRYSOPTERA, Lath. (Syn. *A. mellivora*, Lath., Fam. *Meliphagidæ*).

Plate xxvi., figs. 6, 11.

We are indebted to Dr. T. L. Bancroft for sending us blood-films from eleven birds belonging to this species shot near Brisbane. In four of these no parasites were detected, in three large microfilariæ were present; in two there were two species of microfilariæ, a small form in addition to the larger (*vide infra*); while in two others there were two kinds of filarial embryos as well as a few trypanosomes. Dr. Bancroft detected the presence of these hæmatozoa in some of the films before sending them down to us.

The trypanosomes, very few of which were seen, were about 0·035 mm. in length, the maximum breadth being 0·002 mm. Their form was elongate, the middle portion being uniform in breadth, but gradually narrowing anteriorly and posteriorly, each end being pointed. The anterior extremity was longer and narrower than the posterior. The kinetonucleus was situated at 0·003 mm. from the posterior end. The part between this and the end was only slightly stained, whereas the rest of the body was deeply coloured (Giemsa). The nucleus could not be detected. The undulating membrane was extremely narrow, and appeared to be very short. A flagellum was not recognized.

The occurrence of trypanosomes in Australian birds does not seem to have been recorded previously, consequently Dr. Bancroft's discovery is of considerable interest. A typical film has been donated to the Trustees of the Australian Museum, Sydney.

PROTOZOA (?) present in the blood of ZOSTEROPS CŒRULESCENS.

Plate xxv., figs. 18-20.

In a film from one of the specimens of *Zosterops cœrulescens* in which Halteridia were detected, peculiar bodies were present in considerable numbers. Whether these are protozoa or not we are unable to decide. They had a superficial resemblance to the leucocytozoa of birds, but a definite relationship to any of the cells of the blood could not be established, though they were frequently found in close proximity to injured red cells. That they were adventitious bodies, accidentally incorporated in the films when these were made, seems unlikely, as the slide was practically free from extraneous dirt.

The bodies varied considerably in size and appearance, but presented in general an elongated spindle-shape and a deeply-stained blue body (Giemsa's stain). The length was from 0·008 mm. to 0·0133 mm., and the maximum breadth 0·0025 mm. to 0·004 mm. In some cases one end was gradually pointed and the other bluntly truncated. No definite nuclear apparatus was detected, but in all large, rounded, deep-blue granules were present. Sometimes a dozen or so of these were present, grouped around a central paler area; in others they were fewer and scattered; and in two elongated forms they were present as two deep-blue, spore-like bodies surrounded by paler areas, a little distance on each side from the centre. Sometimes, attached to the more pointed end by a delicate strand, was an almost isolated smaller mass.

MICROFILARIÆ IN THE BLOOD OF AUSTRALIAN BIRDS.

Dr. T. L. Bancroft,(5) in 1889, communicated a paper dealing with the occurrence of filarial embryos in the blood of the following birds from Queensland:—

Eurystomus pacificus, Lath. (in 9 out of 9 examined); *Strepera graculina*, White (in 1 examined); *Gymnorhina tibicen*, Lath. (in 3 out of 4); *Cracticus destructor*, Temm. (in 12 out of 23); *Chibia bracteata*, Gould (in 1 out of 4); *Myiagra rubecula*, Lath. (in 2 out of 4); *Sericulus chrysocephalus*, Lewin (in 3 out of 10); *Oriolus sagittarius*, Lath., syn. *Mimeta viridis*, Lath. (in 2 out of 5); *Corone australis*, Gould (in 2 examined); *Pomatorhinus frivolus*, Lath. (in 5 out of 14); *Myzantha garrula*, Lath. (in 15 out of 16); *Entomyza cyanotis*, Lath. (in 4 out of 10); *Anellobia chrysoptera*, Lath. (in 3 out of 4); *Trichoglossus novæ-hollandiæ*, Gmel. (in 3 out of 6); and *Podargus strigoides*, Lath. (in 2 examined). We have studied microfilariæ from three of these species, namely, *Gymnorhina tibicen*, *Corone australis*, and *Anellobia chrysoptera*.(6)

It may be pointed out that the bird referred to by Dr. Bancroft and one of us as *Anellobia lunulata* is really *A. chrysoptera*, Lath. (syn. *A. mellivora*, Lath.), as the former is only found in Western Australia.(7) The two species, however, very closely resemble each other.

Larval filariæ (Microfilaria sp.) in the Blood of the Black-backed Magpie or Piping Crow-shrike (*Gymnorhina tibicen*, Lath.).

In the blood of *Gymnorhina tibicen*, shot near Sydney in March, 1910, the presence of larval filariæ was noted. The parasites were short, with the anterior end blunt and rounded, the posterior narrowed slightly and also blunt. There was no sheath. The cuticle showed well-marked, delicate, transverse annulations. The body protoplasm stained a deep purple with Giemsa's solution, showing granular masses: one or two of these were isolated at the anterior end, a small clearer area surrounding them, and occupying the extreme anterior end of the parasite. Two, three, or four clear spaces

(5) Bancroft, T. L., Proc. Roy. Soc., Queensland, vi, 1889 (1890), pp. 58-62.

(6) Johnston, T. H., Jour. Proc. Roy. Soc, N.S.W., xliv., 1910, pp. 109, 111, 114.

(7) Matthews, E., "Handlist of the Birds of Australasia," in Emu, vii, 1908, Supplement, p. 99.

were noted in the protoplasm. The length was about 0·11 mm., and the maximum breadth 0·0045 mm.

In films taken from another bird shot near Berry, New South Wales, in August, 1910, a few microfilariæ were detected. These were much smaller than the above, being only 0·045 mm. long by 0·004 mm. broad. The anterior end was not appreciably narrowed, but appeared to be bluntly rounded, whilst the other end gradually narrowed to terminate in a pointed tail. The cuticle possessed fine annulations. The body stained deeply and uniformly.

Larval filariæ (Microfilaria sp.) in the Blood of the Raven (*Corone australis*).

In blood-films from a raven, *Corone australis*, shot near Barraba, New South Wales, in December, 1909, and for which we are indebted to Mr. A. R. MacCulloch, were found larval filariæ of about 0·09 mm. in length, by 0·0038 mm. in breadth. Both ends of these were bluntly rounded, the posterior being narrowed slightly. There was no sheath. The cuticle possessed delicate annulations. The protoplasm was finely granular and stained a deep-blue.

Larval filariæ (Microfilaria sp.) in the Blood of the Brush Wattle-bird (*Anellobia chrysoptera*, Fam. *Meliphagidæ*).

In July, 1907, Dr. T. L. Bancroft, of Brisbane, Queensland, was good enough to forward us blood-films from eleven specimens of *Anellobia chrysoptera*, shot near Brisbane, and accompanied this with a letter stating that in these films would be found apparently two species of filaria and a trypanosome. On examination we found that in four birds the two forms of filaria were present, in three only the larger, and in four none. Two of the birds harbouring both forms were also found to possess trypanosomes.

The two microfilariæ, which appear to us to belong to different species, have characters as follows:—

(1). Larger Form.—The parasites were relatively large, being from 0·16 mm. to 0·19 mm. long by 0·0045 mm. broad, with a blunt anterior end and a gradually finely-pointed posterior end. There was no sheath. The cuticle showed well-marked transverse striations. The body cells stained pale-blue with Giemsa, and were finely granular. The anterior end remained almost unstained, except for the presence of a few partly-isolated masses succeeded by a clear space. The V-spot was well

behind the head; there was a tail spot near the posterior end.

(2). Smaller Form.—The parasites were considerably shorter and smaller, being from 0·06 mm. to 0·09 mm. in length, by 0·0045 mm. in width. The anterior end was blunt; the posterior gradually slightly narrowed, and was also blunt. There was no sheath and no noticeable cuticular striation. The protoplasm of the body cells, stained with Giemsa, assumed a deep-purple tint, and was coarsely granular. There was a large, square, clear space at the junction of the posterior and middle thirds; the V-space (?) was a little in front of the centre.

The difference between the two forms after staining by Giemsa's method was very striking, the larger assuming a pale-blue colour, the smaller a deep purple.

LIST OF AUSTRALIAN BIRDS EXAMINED FOR HÆMATOZOA.

The following is a list of 139 Australian birds, belonging to 77 species, whose blood has been examined by us for hæmatozoa with negative results.

In addition to the name of each species we have appended its number in Matthew's "Handlist of the Birds of Australasia," published in "The Emu," vol. vii., 1908, supplement.

We desire to acknowledge the courtesy of Mr. A. J. North, of the Australian Museum, Sydney, who was good enough to identfy those specimens about which we were uncertain:—

List I.

30. *Lopholæmus antarcticus*, Hawkesbury River, November, 1909.
37. *Phaps chalcoptera*, Sydney, December, 1909.
125. *Sterna bergii* (3 specimens), Perth, W.A., January, 1909.
133. *Anous stolidus* (Noddy), Abrolhos Island, W.A., January, 1908.
137. *Larus novæ-hollandiæ*, Abrolhos Island, W.A., January, 1908.
149. *Zonifer tricolor* (2), Adelaide District, May, 1910.
151. *Charadrius dominicus*, Sydney, March, 1910.
157. *Ægialitis ruficapilla*, Perth, September, 1909.
158. *Ægialitis melanops* (2), Adelaide District, May, 1910.
161. *Himantopus leucocephalus*, Tailem Bend, S.A., May, 1909.
199. *Xenorhynchus asiaticus*, Lath., Sydney Zoo, August, 1910.

204. *Notophoyx novæ-hollandiæ*, Hawkesbury River, August, 1910.
237. *Phalacrocorax carbo*, Hawkesbury River, April, 1910.
258. *Astur fasciatus* (2), Sydney, March, 1910; Adelaide District, May, 1910.
267. *Haliastur sphenurus*, Adelaide District, May, 1910.
280. *Cerchneis cenchroides*, Bathurst, December, 1909.
307. *Glossopsittacus concinnus* (2), Berry, July, 1909.
308. *Glossopsittacus porphyrocephalus*, Adelaide District, May, 1910.
343. *Platycercus eximius* (2), Orange, July, 1909; Bowral, May, 1910.
354. *Psephotus hæmatorrhous*, Moree, October, 1909.
361. *Psephotus hæmatonotus* (2), Orange, July, 1909.
376. *Podargus strigoides*, South-East Queensland, July, 1910.
407. *Cacomantis flabelliformis* (2), Hawkesbury River, November, 1909; Berry, August, 1910.
412. *Chalcococcyx plagosus*, Perth, September, 1909.
429. *Hirundo neoxena*, Sydney, March, 1910.
433. *Micrœca fascinans* (3), Sydney, April, 1909, March, 1910; Bowral, May, 1910.
438. *Petrœca Leggei*, Adelaide District, May, 1910.
440. *Petrœca phœnicea* (3), Adelaide District, May, 1910 (2); Bowral, May, 1910.
443. *Petrœca rosea*, Hawkesbury River, June, 1909.
444. *Petrœca Goodenovii* (2), Adelaide District, May, 1910; Tailem Bend, S.A., May, 1910.
446. *Petrœca bicolor*, Adelaide District, May, 1910
449. *Smicrornis brevirostris* (2), Tailem Bend, S A., May, 1910.
459. *Pseudogerygone fusca*, Berry, July, 1910
487. *Rhipidura tricolor* (3), Sydney, April, 1909 (2); June, 1909.
493. *Sisura inquieta*, Tailem Bend, S.A., May, 1910.
504. *Coracina robusta*, Berry, August, 1910.
526. *Psophodes crepitans*, Sydney, April, 1910
557. *Origma rubricata* (2), Hawkesbury River, June, 1909.
568. *Acanthiza pyrrhopygia*, Tailem Bend, S.A., May, 1910.
569. *Acanthiza lineata* (4), Sydney, November, 1909, (2), August, 1910; Adelaide District, May, 1910.
574. *Acanthiza chrysorrhoa*, Berry, August, 1910.
575. *Acanthiza reguloides*, Bowral, May, 1910.
582. *Sericornis frontalis*, Sydney, April, 1910.
586. *Sericornis maculata*, Adelaide District, May, 1910.
593. *Malurus cyanochlamys* (4), Orange, July, 1909 (2); Adelaide District, May, 1910 (2).

602. *Malurus lamberti* (2), Hawkesbury River, September and October, 1909.
625. *Artamus superciliosus*, Bathurst, December, 1909.
634. *Artamus tenebrosus*, Sydney, March, 1910.
636. *Collyriocichla harmonica* (3), Sydney, March, 1909, June, 1910; Hawkesbury River, October, 1909.
646. *Grallina picata*, Sydney, June, 1909.
660. *Falcunculus frontatus*, Tamworth, October, 1909.
667. *Pachycephala pectoralis*, Hawkesbury River, June, 1909, February, 1910.
674. *Pachycephala rufiventris* (3), Tamworth, October, 1909; Hawkesbury River, October, 1909, November, 1909.
683. *Eopsaltria australis* (3), Sydney, May, 1909, August, 1909, August, 1910.
689. *Aphelocephala leucopsis*, Adelaide District, May, 1910
704. *Climacteris picumna* (4), Moree, October, 1909; Sydney, March, 1910; Adelaide District, May, 1910; Bowral, May, 1910.
705. *Climacteris scandens* (2), Sydney, March, 1909, April, 1909.
709. *Zosterops Gouldi*, Perth, September, 1909.
726. *Pardalotus punctatus* (2), Hawkesbury River, June, 1909.
741. *Melithreptus brevirostris* (4), Sydney, April, August, November, 1909, March, 1910.
752. *Acanthorhynchus tenuirostris* (2), Sydney, May, 1909; Hawkesbury River, February, 1910.
756. *Glycyphila melanops* (3), Sydney, April, November, 1909, April, 1910.
764. *Meliphaga phrygia*, Hawkesbury River, April, 1909.
770. *Ptilotis chrusotis* (4), Hawkesbury River, June, December, 1909 (2), April, 1910.
772. *Ptilotis sonora*, Adelaide District, May, 1910.
778. *Ptilotis leucotis* (5), Hawkesbury River, April, June, October, 1909; Sydney, March, 1909, March, 1910.
781. *Ptilotis melanops* (3), Hawkesbury River, April, 1909; Sydney, April, 1909, August 1910.
791. *Ptilotis penicillata*, Orange, July, 1909.
797. *Meliornis pyrrhoptera*, Adelaide District, May, 1910.
801. *Meliornis sericea* (4), Sydney, March, 1909 (2), March, July, 1910.
804. *Myzantha garrula*, Orange, July, 1909.
806. *Myzantha flavigula*, Moree, October, 1909.
810. *Anellobia chrysoptera* (2), Hawkesbury River, September, 1909; Sydney, March, 1910.
822. *Anthus australis*, Sydney, April, 1909.

838. *Ægintha temporalis* (7), Sydney, March, 1910, April, 1910 (2); Berry, August, 1910 (4).
850. *Oriolus sagittarius* (2), Hawkesbury River, April, 1909; Berry, August, 1910.
883. *Corcorax melanorhampus*, Berry, May, 1910.

List II.

The following is a list of eight birds belonging to five species introduced into Australia in all of which blood examinations for hæmatozoa were negative:—

Turtur suratensis (Indian dove), Sydney, November, 1909.
Sturnus vulgaris (common starling), (2), Sydney, April, 1909; Berry, May, 1909.
Fringilla chloris (greenfinch), Sydney, March, 1910.
Carduelis elegans (goldfinch), (3), Adelaide District, May, 1910.
Merula merula, Linn. (syn. *Turdus merula*), (blackbird), Adelaide, May, 1910.

List III.

List III. comprises those Australian species in some members of which we have detected hæmatozoa. It consists of thirteen species, represented by fifty-six specimens, twenty-two of which harboured blood parasites. In some specimens, *e.g.*, *Anellobia chrysoptera*, both filariæ and trypanosomes were present.

Halteridia were found by us in the following eleven species:—

227. *Nettium castaneum*, Broughton Island, N.S.W., 1907 (in 1 examined).
283. *Ninox boobook (?)* South-East Queensland, July, 1910 (in 1 examined).
490. *Myiagra nitida*, Hawkesbury River, November, 1909 (in 1 examined).
530. *Pomatorhinus superciliosus*, Hallett's Cove, near Adelaide, May, 1910 (in 1 examined); Tailem Bend, S.A., May, 1910 (2, *nil*).
544. *Oreocichla lunulata*, Bulli, N.S.W., April, 1909 (in 1 examined).
712. *Zosterops cærulescens*, Sydney, May, 1909, February, 1910 (in 1 out of 2), April, 1910 (in 1 out of 2), June, 1910 (4, *nil*), July, 1910 (2, *nil*), August, 1910 (2, *nil*); Adelaide, May, 1910 (2, *nil*).
733. *Melithreptus atricapillus*, Sydney, July, 1909 (in 1 out of 2).

775. *Ptilotis chrysops*, Hawkesbury River, April, 1909 (in 1 out of 2 examined); Sydney, July, 1909 (1, *nil*).
787. *Ptilotis plumula*, Perth, W.A., 1909 (in 1 examined).
799. *Meliornis novæ-hollandiæ*, Sydney, March, 1909 (in 1 out of 2), August, 1909 (1, *nil*), April, 1910 (1 *nil*), July, 1910 (1, *nil*), August, 1910 (2, *nil*).
818. *Tropidorhynchus corniculatus*, Hawkesbury River, April, 1909 (in 1 examined).

Trypanosomes were found in one species:—

810. *Anellobia chrysoptera*, Hawkesbury River, September, 1909 (1, *nil*); Sydney, March, 1910 (1, *nil*); South-East Queensland, July, 1910 (trypanosomes found in 2 out of 11 examined).

Microfilariæ were found in three species.—

647. *Gymnorhina tibicen*, Berry, May, 1909 (1, *nil*): Bowral, May, 1910 (2, *nil*): Sydney, March, 1910 (in 1 examined); Berry, August, 1910 (in 1 examined).
810. *Anellobia chrysoptera*, Hawkesbury River, September, 1909 (1, *nil*): Sydney, March, 1910 (1, *nil*); South-East Queensland, July, 1910 (in 7 out of 11 examined).
847. *Corone australis*, Barabba, N.S.W., December, 1909 (in 1 out of 2 examined).

List IV.

List IV. includes an introduced species, in two members of which we have found hæmatozoa (*Plasmodium passeris*, Johnston and Cleland):—

Passer domesticus (sparrow), Richmond, N.S.W., May, 1909 (1, *nil*); Sydney, May, 1909 (in 2 examined); Adelaide, May, 1910 (2, *nil*).

It will be seen from the above lists that of 195 Australian birds examined, representing ninety species, Halteridia were found in twelve birds belonging to eleven species. The percentage of infected hosts was thus about six. The percentage of species found to be infected was about twelve. Trypanosomes were found in two individuals belonging to one species, the infection being about 0·5 per cent. of the total number of specimens examined. In regard to microfilariæ, we found them in ten birds belonging to three species. Thus about 5 per cent. of the total number of birds examined were found to harbour filarial embryos. Bancroft (8) in 1889 examined 114 birds belonging to fifteen species harbouring

(8) Bancroft, T. L., Proc. Roy. Soc., Queensland, vi. (1889-1890), pp. 58-62.

microfilariæ in Queensland, and found sixty-seven to be infected, the percentage of infected birds in the species thus being nearly sixty. He did not give a list of those species in which microfilariæ were not found by him.

Amongst thirteen specimens of introduced birds belonging to six species, plasmodia were found in two birds belonging to one species.

ADDENDUM.

A paper entitled "Notes on Blood-parasites" by Gilruth, Sweet, and Dodd has recently appeared in Proc. Roy. Soc., Victoria, xxiii. (n.s.), pp. 231-241. A Plasmodium *(P. biziuræ,* n. sp.) is described from a musk duck *(Biziura lobata)* (pp. 231-4), and microfilariæ *(M. gymnorhinæ,* n. sp.) from a magpie *(Gymnorhina tibicen)* in Victoria (pp. 236-9). We have refrained from attaching names to the microfilariæ examined by us, as a name given to the larva becomes the correct specific name for the adult when found, and, moreover, it is not an easy matter to refer a particular larva to a particular adult. It seems to us that the different types of microfilariæ in one host may belong to different species of filariidæ, and the naming of all the embryos from one host under one name may thus lead to confusion.

DESCRIPTION OF PLATES.

Plate XXV.

All the figures have been drawn to the same scale.

Fig. 1. Normal erythrocyte of *Pomatorhinus superciliosus.*
,, 2- 5. Halteridium, sp., in red cells of *P. superciliosus.*
,, 6. Normal erythrocyte of *Melithreptus atricapillus.*
,, 7-10. Infected erythrocytes of *Melithreptus atricapillus.*
,, 11. Normal erythrocyte of *Zosterops cærulescens.*
,, 12-17. Infected erythrocytes of *Zosterops cærulescens.*
,, 18-20. Protozoa (?) from blood of *Zosterops cærulescens.*

Plate XXVI.

Fig. 1. Normal red cell of *Myiagra nitida.*
,, 2- 5. Infected red cell of *Myiagra nitida.*
,, 6, 11. *Trypanosoma anellobiæ,* from *Anellobia chrysoptera.*
,, 7. Normal erythrocyte of Owl.
,, 8-10. } Infected red cells of Owl.
,, 12-15. }
,, 16. Normal erythrocyte of *Ptilotis plumula.*
,, 17-22 Infected erythrocytes of *Ptilotis plumula.*

Notes on South Australian Marine Mollusca, with Descriptions of New Species.—Part XIII.

By Jos. C. Verco, M.D. (Lond.), F.R.C.S. (Eng.).

[Read October 4, 1910.]

Plates XXIX. and XXX.

This paper consists of full notes on the South Australian species of the genera *Scissurella*, *Schismope*, *Pyrene*, and *Turritella*, and of occasional notes on species belonging to several other genera.

I am indebted to Mr. Hedley, Mr. W. L. May, Mr. Gatliff, and Mr. Gabriel for specimens given or loaned and suggestions made. The usual difficulty was found in dealing with the mass of material in the genus *Pyrene*, owing to the variations in each species. Pace, in his preliminary paper on the *Columbellidæ* (in Proc. Mal. Soc., London, 1902, vol v., p. 39) regards the colour markings as of considerable value in distinguishing species, and I set myself the task of studying these very closely; but I cannot say they proved of very great or very definite use, though of some assistance. My conclusions are not altogether in accord with those of other Australian workers, and are intended rather as suggestions for further advances. I found great difficulty, too, in dealing with the deep-sea *Turritellas*, especially the larger forms belonging to the group of *T. runcinata* and *T. accisa*, Watson. He has several species from Australian waters which I cannot recognize with certainty, and my examples show so much variation in sculpture as to make splitting them up into species too dangerous, and to render their accurate description as varieties too difficult and laborious at present.

Scissurella australis, Hedley.

Scissurella australis, Hedley, Memoirs Austr. Mus., 1903, part 6, vol. iv., p. 329, fig. 63. *Type locality*—"63 to 75 fathoms off Port Kembla, New South Wales." Gatliff and Gabriel, Proc. Roy. Soc., Victoria, 1910, vol. xxiii. (N.S.), part 1, p. 95, "off Wilson's Promontory."

Dredged in 130 fathoms off Cape Jaffa, 4 dead; in 150 fathoms off Beachport, 1 good; in 200 fathoms, 1 good: in 300 fathoms off Cape Jaffa, 4 dead. Identified by Mr. Hedley from his type.

Scissurella obliqua, Watson.

Scissurella obliqua, Watson, "Chall." Reports, Zool., vol. xv., 1886, p. 116, pl. viii., fig. 5. *Type locality*—"Kerguelen Island

shore." Pilsbry, Tryon, Man. Conch., 1890, vol. xii., p. 58, pl. lxv., figs. 20 and 21; Pritchard and Gatliff, Proc. Roy. Soc., Victoria, 1903 (1902), vol. xv. (N.S.), part 2, p. 181, Victorian coast.

Gulf St. Vincent beach

Schismope atkinsoni, Tenison-Woods.

Scissurella atkinsoni, Tenison-Woods, Proc. Roy. Soc., Tasmania, 1877 (1876), p. 149. *Type locality*—Blackman's Bay, Tasmania, 6 to 10 fathoms; G. F. Angas, Proc. Zool. Soc., London, 1878, p. 869, "Holdfast and Aldinga Bays." Pilsbry, Tryon, Man. Conch., 1890, vol. xii., p. 66; Tate and May, Proc. Linn. Soc., New South Wales, 1901, vol. xxvi., p. 407; Pritchard and Gatliff, Proc. Roy. Soc., Victoria, 1903 (1902), vol. xv. (N.S.), part 2, p. 181, Victorian coast; Hedley, Memoirs Austr. Mus., 1903, vol. iv., p. 329, off Port Kembla, New South Wales; also, Records Austr. Mus., 1905, vol. vi., part 2, p. 42; Hedley and May, Records Austr. Mus., 1908, vol. vii., No. 2, p. 109, 100 fathoms off Cape Pillar, Tasmania.

Schismope carinata, Watson, "Chall." Reports, Zool., 1886, vol. xv., p. 119, pl. viii., fig. 6. *Type locality*—Port Jackson, also off Cape York, North-East Australia. Pilsbry, Tryon, Man. Conch., 1890, vol. xii., p. 68, pl. lxv. (lxviii.), figs. 17 to 19.

This is a very variable little shell in its sculpture. There may be no carination except that of the slit fascicle (is this *S. tasmanica*, Petterd, Jour. of Conch., 1879, p. 104; Tate and May, Proc. Linn. Soc., New South Wales, 1901, vol. xxvi., part 3, p. 407, pl. xxiv., fig. 23 ?), or only one keel, or two or three. The spiral liræ around the umbilicus may be valid, when the three keels are marked, continuing their series as lesser keels to the edge of the umbilicus; or they may be distinct and lamellose when the keels are absent. Spiral striæ are present from suture to umbilicus, and these vary much in their visibility. Then the axial striæ are sometimes obsolete, sometimes rather distant, sometimes distinct, crowded, and erect, especially between the suture and the slit fasciole, but also sometimes between the keels at the base.

Dredged in 20 fathoms Investigator Strait, 1 alive; Gulf St. Vincent, depth unrecorded, 13 alive and dead; 35 fathoms off St. Francis Island, 2 good; 55 fathoms off Cape Borda, 11 dead; also 62 fathoms, 4 dead.

Schismope beddomei, Petterd.

Schismope Beddomei, Petterd, Jour. of Conch., 1884, vol. iv., p. 139, No. 16.

This species was recorded in Adcock's Handlist of the Aquatic Mollusca of South Australia, 1893, No. 375, p. 9, and in the Report of the Malacological Section of the Royal Society of South Australia in Trans. Roy. Soc., South Australia, 1906, vol. xxx., p. 367, No. 49. I cannot confirm this

record. The species is not represented in Tate's cabinet or mine by shells collected in South Australia.

Schismope pulchra, Petterd.

Schismope pulchra, Petterd, Jour. of Conch., 1884, vol. iv., p. 139, No. 17. *Type locality*—Tasmania, North-West coast. Pilsbry, Tryon, Man. Conch., 1890, vol. xii., p. 68; Hedley, Proc. Linn. Soc., New South Wales, 1900, vol. xxv., part 4, p. 726, fig. 5; Tate and May, Proc. Linn. Soc., New South Wales, 1901, vol. xxvi., part 3, page 407; Pritchard and Gatliff, Proc. Roy. Soc., Victoria, 1903 (1902), vol. xv. (N.S.), part 2, page 182, Western Port; also, *op. cit.*, 1906, vol. xviii., part 2, p. 65; Hedley and May, Records Austr. Mus., 1908, vol. vii., No. 2, p. 109, 100 fathoms off Cape Pillar, Tasmania.

Taken on beach at Robe and Venus Bay. Dredged in Gulf St. Vincent, 5 good; in 35 fathoms off St. Francis Island, 1; in 55 fathoms off Cape Borda, 16 dead; in 110 fathoms off Beachport, 4 good; in 150 fathoms off Beachport, 2 good.

Leiostraca joshuana, Gatliff and Gabriel.

Leiostraca joshuana, Gatliff and Gabriel, Proc. Roy. Soc., Victoria, vol. xxiii. (N.S.), part 1, 1910, p. 83, pl. xviii., fig. 4. *Type locality*—San Remo.

Dredged in 5 fathoms in Gulf St. Vincent, 37 living and dead.

Vanikoro quoyiana, A. Adams.

Vanikoro quoyiana, A. Adams, Proc. Zool. Soc., London, 1853, p. 175, pl. xx. fig. 4. *Type locality*—Chusan; Angas, Proc. Zool. Soc., London, 1867, p. 212, No. 163, Port Jackson; Pritchard and Gatliff, Proc. Roy. Soc., Victoria, 1900 (1899), vol. xii. (N..S.), part 2, p. 197, "Hobson's Bay."

This name is given by E. A. Smith as a synonym of *V. gaimardi*, H. and A. Adams (Genera Moll., 1858, vol. i., p. 375), in Proc. Mal. Soc., London, 1908, vol. viii., No. 2, p. 108. It was placed as *V. quoyi*, Adams, as a synonym of *V. Orbignyani*, Recluz, by Tryon, Man. Conch., 1886, vol. viii., p. 70; but E. A. Smith denies their identity. As *V. Orbignyani*, Recluz, it is recorded from Tasmania by Tate and May, Proc. Linn. Soc., New South Wales, 1901, vol. xxvi., p. 376. As *Narica ligata*, Recluz, it is recorded for South Australia in Adcock's Handlist of Aquatic Mollusca, 1893, p. 6, No. 176.

Taken on the beach at Aldinga and Fowler Bay by Tate. Dredged in 20 fathoms Yankalilla, 6 alive on 1 piece of polyzoan coral; dead in 40 fathoms off Beachport, 2; in 45 fathoms east of Neptune Island, 1; in 55 fathoms off Cape Borda, 74 quite fresh but very small; in 62 fathoms, 4; in 110 fathoms off Beachport, 1 poor; in 130 fathoms off Cape

Jaffa, 2 poor; in 150 fathoms off Beachport, 1 poor. It is evidently alive in water up to 55 fathoms.

The protoconch is prominent, consisting of three well-rounded whorls, of which the first two are smooth, the third gradually develops four spirals of tiny tubercles. It ends abruptly, and then the very bold axial costate sculpture of the spire-whorls begins. The protoconch may be wholly light-brown or only its third whorl.

Vanikoro vincentiana, Angas.

Adeorbis Vincentiana, Angas, Proc. Zool. Soc., London, 1880, p. 417, pl. xl., fig. 9. *Type locality*—Aldinga Bay, Gulf St. Vincent. Tate, Trans. Roy. Soc., South Australia, 1880, vol. iii., p. xlix.; Pilsbry, Tryon, Man. Conch., 1888, vol. x., p. 86, pl. xxx., fig 100; Adcock, Handlist Aquatic Moll., South Australia, 1893, p. 8, No. 292; Pritchard & Gatliff, Proc. Roy. Soc., Victoria, 1900, vol. xiii. (N.S.), part 1, p. 140, "Sorrento"; Tate and May, Proc. Linn. Soc., New South Wales, 1901, vol. xxvi., part 3, p. 390, "Devonport," Tasmania; also p. 458, description of protoconch and young shell

Vanikoro vincentiana, Angas, E A Smith, Proc. Mal. Soc., London, 1908, vol. viii., p. 116.

Vanikoro denselaminata, Verco, Trans. Roy. Soc., South Australia, 1909, vol. xxxiii., p. 334, pl. xxix., figs. 1, 2, and 3. Mr. Gatliff has suggested that this is the juvenile state of *V. vincentiana*, Angas, as may also be gathered from Tate and May's note, and this is confirmed by my examination of a series of Angas's species; so I place my name as a synonym and add the following observations:—Some examples show spirals in the whorl immediately following the protoconch, in others these are obsolete. In the later portions of the adult shell, the axials become obsolete, and crowded spirals may become quite valid.

Taken on the beach at Reevesby Island, Spencer Gulf, and St. Francis Island. Dredged in Backstairs Passage and Gulf St. Vincent, depth unrecorded. It appears to be a comparatively shallow water form, not having been taken by me at any greater depth than 22 fathoms.

Turritella subsquamosa, Dunker.

Turritella subsquamosa, Dunker, Malak. Blatter, vol. xviii., p. 152. *Type locality*—Bass Strait; Hedley, Memoirs Austr. Mus., vol. iv., part 6, 1903, p. 347, off coast of New South Wales in 40 to 100 fathoms; Pritchard and Gatliff, Proc. Roy. Soc., Victoria, 1906, vol. xviii. (N.S.), part 2, p. 53, Victorian coast; Hedley and May, Records Austr. Mus., 1908, vol. vii, No. 2, p. 110, 100 fathoms off Cape Pillar, Tasmania.

Turritella lamellosa, Watson, Jour. Linn. Soc., 1880, vol. xv., p. 229. *Type locality*—38 to 40 fathoms off East Moncoeur Island, Bass Strait. "Chall." Reports, Zool., vol. xv., 1886, p. 474, pl. xxix., fig. 6; Pritchard and Gatliff, Proc. Roy. Soc., Victoria, 1900 (1899), vol. xii. (N.S.), part 2, p. 203; Tate and May, Proc. Linn. Soc., New South Wales, 1901, vol. xxvi., part 3, p. 378.

Turritella acuta, Tenison-Woods, Proc. Roy. Soc., Tasmania, 1876 (1875), p. 143. *Type locality*—Long Bay, Tasmania (*non* M. C. Mayer, 1859, Jour. de Conch., vol. vii., p. 298, pl. xi., fig. 7); *(Torcula)*, Tryon, Man. Conch., 1886, vol. viii., p. 206, pl. lxiv., fig. 10; Kobelt, Conch. Cab. (Ed. Küster), 1897, Band i., Abt. xxvii., p. 56, No. 70, pl. xviii., fig. 5; Adcock, Handlist Aquatic Moll. of South Australia, 1893, p. 6, No. 189; recorded for South Australia.

Turritella oxyacris, Tate (*nom. mut.*), Trans. Roy. Soc., South Australia, 1897, vol. xxi., p. 41; Pritchard and Gatliff, Proc. Roy. Soc., Victoria, 1900 (1899), vol. xii. (N.S.), part 2, p. 202; recorded for Victoria.

Dredged alive in 20 and 22 fathoms in Backstairs Passage, and in 20 fathoms Gulf St. Vincent. Dredged dead from 13 fathoms upwards; in 40 fathoms off Beachport, 60 large and small, mostly worn; in 55 fathoms off Cape Borda, 57, up to an inch long; in 110 fathoms off Beachport, 16 in moderate condition; in 130 fathoms off Cape Jaffa, 6 very poor; in 200 fathoms off Beachport, 1 fragment. It appears to live at about 20 fathoms, not in the very shallow nor in the very deep water. Some of the shells from 40 fathoms have axial lines, about 16 in a whorl, which seem like cracks in the deeper layer of the shell substance, and become visible as the outer scabrous covering is worn off.

On the base there may be as many as twelve distinct spiral liræ, or only three or four obsolete threads near the periphery. Generally three or four larger threads encircle the middle third of the spire-whorls; sometimes twelve or fourteen of nearly equal size are distributed over the whorl. The peripheral cord may be very stout, and project considerably beyond the suture, so imbricating the whorl below; or it may not project at all, and the whorls may be uniformly sloping or distinctly convex.

Turritella clathrata, Kiener.

Turritella clathrata, Kiener, Icon. Coq. Viv., p. 38, pl. xiv., fig. 1. *Type locality*—Shores of New Holland. Reeve, Conch. Icon., 1849, vol. v., pl. viii., fig. 37; *(Torcula)*, Tryon, Man. Conch. 1886, vol. viii., p. 206, pl. lxiv., fig. 2; Kobelt, Conch. Cab. (Ed. Küster), Band i., Abt. xxvii., 1897, p. 26, No. 35, pl. vi., fig. 5, and pl. vii., fig. 5; Adcock, Handlist of Aquatic Moll., South Australia, 1893, p. 6, No. 190, recorded for South Australia; Pritchard and Gatliff, Proc. Roy. Soc., Victoria, 1900 (1899), vol. xii. (N.S.), part 2, p. 202, "South-west Victorian coast"; Tate and May, Proc. Linn. Soc., New South Wales, 1901, vol. xxvi., part 3, p. 378, recorded for Tasmania.

Kiener in his description and plate represents the species as quite smooth. But actually besides the two prominent keels there are seven to ten spiral striæ, generally one more above the carina than below. In addition there are, crossing these, very fine lamellar striæ, following the curve of the

border of the aperture. So also the base, which he gives as smooth, has crowded fine curving radial growth lamellæ, crossing about a dozen concentric spiral striæ. He figures rightly the two spiral ribs as about equal; the central is usually more salient, but in different specimens it may be less and less valid until it is no more than a distinct angulation. In other individuals the lower, supra-sutural, spiral cord, which is usually quite valid and imbricating, may be less marked and even absent, only the prominent central carina remaining. In one example, three whorls in the middle of the shell are markedly medially angulate, and not only lack the suprasutural cord, which is present in the earlier whorls, but are quite constricted here, and afterwards the cord gradually appears in the whorls below. The protoconch of two smooth glistening whorls with its pointed apex and the earlier spire-whorls are so alike in this species and *T. subsquamosa*, Dunker, that the tips of the two are indistinguishable from each other. Kiener's type had a length of 48 mm., but the species may attain 53 mm. As Tryon says, there are obscure oblique fulvous stripes over the whorls with spots on the paler keels; but sometimes the living shell is of a uniform dark-purplish-brown, with lighter brown encircling ribs.

It is taken along all the South Australian coast as far west as Point Sinclair. Dredged alive in 20 fathoms in Gulf St. Vincent, and at all shallower depths; dead in 35 fathoms off St. Francis Island, 3 very poor; and in 45 fathoms off Neptune Islands, 1 poor, half an inch long It evidently does not inhabit such deep water as its very close ally *T. subsquamosa*, Dunker.

Turritella kimberi, Verco.

Turritella kimberi, Verco, Trans. Roy. Soc., South Australia, 1908, vol. xxxii., p. 342, pl. xv., figs. 14 and 15. *Type locality*—Backstairs Passage.

Dredged in Gulf St. Vincent, 1 good; and in 15 to 20 fathoms off St. Francis Island, 1 good.

Turritella neptunensis, n. sp. Pl. xxx., fig. 7

Shell imperfect, elongate-turreted, of twelve whorls, including a papillate protoconch with a projecting apex, of three convex whorls, the first two smooth, the third faintly axially striate. The following six spire-whorls are markedly medially angulate and minutely carinate, otherwise smooth. The next two whorls become quite convex, and have about seven obsolete flat spiral liræ, most marked near the carina, which forms the central and largest one. The rest of the shell is broken

away. Suture distinct, faintly margined. The accremental striæ indicate a slightly concave outer lip.

Dim.—Length, 6 mm.; breadth 1·4 mm.

Locality.—Type dredged in 104 fathoms 35 miles south-west of Neptune Islands, with three others, all imperfect.

Diagnosis.—Though incomplete, its characters are so distinct as to readily separate it from all other South Australian forms It resembles *T. kimberi*, Verco, in its long narrow form, its simple mouth and spiral striæ; but *T. kimberi* has a very acute apex, its whorls are all convex, and its spirals are narrower and higher. It differs from *T. atkinsoni* in its smaller size, narrower form, and the roundness of its later whorls.

Type in my collection.

Turritella smithiana, Donald.

Turritella (Colpospira) Smithiana, Donald, Proc. Mal. Soc., London, 1900, vol. iv., p. 55, No. 1, pl. v., figs. 1 and 1c. *Type locality* 410 fathoms off Sydney. Hedley, Memoirs Austr. Mus., 1903, vol. iv., part 6, p. 349, is "not Australian, but probably an Atlantic form"; Hedley and May, Records Austr. Mus., 1908, vol. vii., No. 2, p. 110, in 100 fathoms off Cape Pillar, Tasmania; Gatliff and Gabriel, Proc. Roy. Soc., Victoria, 1909, vol. xxii. (N S.) part 1, p. 39, San Remo.

Dredged in 130 fathoms off Cape Jaffa, 1 good; in 150 fathoms off Beachport, 1; in 200 fathoms, 1; in 300 fathoms, 32 good, but all dead.

Turritella mediolevis, n. sp. Pl. xxx., figs. 5 and 6.

Shell small, elongately-turreted, narrow, of eleven whorls, including a slightly eccentric protoconch of two convex smooth whorls. The spire-whorls at first are flat and sloping, but later gradually become more convex, until they are quite round The suture is distinct, subcanaliculate in the earlier part. The base is round. Aperture nearly round, widely effuse in front. Outer lip thin, with a deep central sinus; inner lip thin, rather expanded over a minute perforation. The upper spire-whorls are smooth but for two indistinct bands, one below and one above the suture. In the fifth whorl each of the bands divides into two, and these increase in number in successive whorls, leaving the central part smooth (whence the specific name) but gradually narrowing, until in the penultimate there are about eight somewhat unequal low flat spirals encircling the whole surface. In the body-whorl there are about fifteen flat spirals from the suture to the base of the shell. They are crossed by sinuous axial striæ, shaped like the outer lip. Colour white, light-brown at the base and below the suture.

Dim.—Length, 5·2 mm.; breadth, 1·5 mm.; another example of thirteen whorls is 6·2 mm. long.

Locality.—Type, 62 fathoms off Cape Borda, with very many others; and at 55 fathoms, 2; in 40 fathoms off Beachport, many; in 104 fathoms off the Neptunes, many.

Diagnosis.—From *T. smithiana*, Donald, by the smooth upper whorls and the more numerous and less valid spirals in the later whorls; from *T. kimberi*, Verco, by the blunt two-whorled protoconch; from *T. accisa*, Watson, by its narrower smaller form, its more convex later whorls and their less valid spirals.

Type in my collection.

Turritella opulenta, Hedley.

Turritella opulenta, Hedley, Records of Austr. Mus., 1907, vol. vi., part 4, p. 292, pl. liv., fig. 9. *Type locality*—80 fathoms off Narrabeen, New South Wales. Hedley and May, *op. cit.*, 1908, vol. vii., No. 2, p. 110, 100 fathoms off Cape Pillar, Tasmania.

Dredged in 55 fathoms off Cape Borda, 6 small, good; identified from specimen sent by Mr. May from Cape Pillar.

Turritella runcinata, Watson.

Turritella runcinata, Watson, Jour. Linn. Soc., vol. xv., 1881, p. 217. *Type locality*—38 to 40 fathoms off East Moncoeur Island, Bass Strait. "Chall." Reports, Zool., vol. xv., 1886, p. 475, No. 14, pl. xxx., fig. 3; Miss Donald, Proc. Mal. Soc., London, 1900, p. 47, pl. v., figs. 7 and 7*a*; Pritchard and Gatliff, Proc. Roy. Soc., Victoria, 1900 (1899), vol. xii. (N.S.), part 2, p. 203; Verco, Trans. Roy. Soc., South Australia, 1907, vol. xxxi., p. 308, pl. xxix., fig. 14, of the radula.

Watson's dimensions are: Height, 1·25 in.; breadth, 0·4 in.; least, 0·38; but they may reach 1·8 in. by 0·5 in.

The colour may be a deep uniform chestnut-brown or a pure white with light-brown apex, and spots and flecks of light-yellowish-brown. There is also a lilac-tinted variety, with a pale diffused broad lilac band over the central third, extending sometimes as far as the lower suture.

This species is quite common as a dredged shell. It has been taken in 16 fathoms, and at all greater depths up to 23 fathoms, in Gulf St. Vincent and Backstairs Passage, alive and dead 106 examples; in 25 fathoms Thorny Passage, 5 good up to 20 mm.; in 35 fathoms off St. Francis Island, 22 good; in 40 fathoms off Beachport, over 800 mostly immature, but ranging up to 37 mm.; in 55 fathoms off Cape Borda, 640 with some hundreds of tips; in 62 fathoms off Cape Borda, 82 good up to 25 mm.; in 90 fathoms off Cape

Jaffa, 16 up to 15 mm. and over a hundred tips; in 110 fathoms off Beachport, 1 adult and 191 up to 20 mm.; in 130 fathoms off Cape Jaffa, 42 up to 7 mm.; in 150 fathoms off Beachport, 17 up to 15 mm.; in 200 fathoms off Beachport, 8 poor and small. The finest examples, as to size and condition, are found in water from 15 to 25 fathoms; beyond that depth, though much more abundant, they are immature or smaller.

Turritella accisa, Watson.

Turritella accisa. Watson, Jour. Linn. Soc., London, 1881 (1800), vol. xv., p. 220. *Type locality*—Off East Moncoeur Island, Bass Strait, 38 to 40 fathoms: also "Chall." Reports, Zool., 1886, vol. xv., p. 476, No. 15, pl. xxx., fig. 4; Pritchard and Gatliff, Proc. Roy. Soc., Victoria, 1900 (1899), vol. xii. (N.S.), part 2, p. 203; Tate and May, Proc. Linn. Soc., New South Wales, 1901, vol. xxvi., part 3, p. 379; Hedley and May, Records Austr. Mus., 1908, vol. vii., No. 2, p. 110, in 100 fathoms off Cape Pillar, Tasmania.

Turritella higginsi, Petterd, Jour. Conch., 1884, p. 135. *Type locality*—Tamar Heads, Tasmania, *teste* Tate and May, *loc. cit.*

Dredged in 40 fathoms off Beachport, 211 of all sizes to adult; in 55 fathoms off Cape Borda, 3 young fresh, 3 adult perfect; in 62 fathoms off Cape Borda, 69 quite fresh up to full grown and 9 perfect adult; in 90 fathoms off Cape Jaffa, 24 good, well coloured, 32 immature; in 110 fathoms off Beachport, 22 good adult, 28 immature: in 130 fathoms off Cape Jaffa, 11 immature; in 150 fathoms off Beachport, 23 in moderate condition up to adult, 16 immature fresh; in 200 fathoms off Beachport, 11 poor and immature. The *habitat* of this species differs somewhat from that of *T. runcinata,* Watson, which attains its maximum size and is abundant in water from 15 to 25 fathoms. *T. accisa* has not been taken by me at shallower depths than 40 fathoms; it did not accompany *T. runcinata* in 35 fathoms off St. Francis Island.

Turritella circumligata, n. sp. Pl. xxx., figs. 3 and 4.

Shell solid, of thirteen whorls, including a protoconch of two smooth convex whorls with a prominent round apex. The first three spire-whorls are smooth but for faint growth lines, and are very slightly convex. The fourth has four spiral cords very faintly marked, which become very stout in the later whorls. The suprasutural cord, the strongest, is round and projects beyond the suture, so as to imbricate the shell; the infrasutural is as wide, but not so high, and slopes from the suture; close to this cord is a much narrower and less prominent one, and further removed from this and closer to the suprasutural cord is another round spiral. In the last

two whorls a fifth small cord appears above the suture. The base is flatly rounded, with five flat low spiral cords. The aperture is squarely round, slightly effuse near the columella, which is curved; inner lip, a broad glaze; outer lip simple, smooth inside, corrugated outside by the spirals, with a deep broad sinus well rounded at its depth between the two smaller cords; growth lines corresponding in outline with the outer lip constitute the only other sculpture. It has a pale-yellow-brown tint, with darker brown spirals between the cords, and a broad brownish spiral over the middle of the base.

Dim.—Length, 17 mm.; breadth, 6 mm.

Locality.—Type in 110 fathoms off Beachport, with 11 others good; in 150 fathoms, 8 poor; in 130 fathoms off Cape Jaffa, 9 good.

It may reach 22·5 mm. in length. The suprasutural and infrasutural cords may each split in the later whorls at its upper part to form a small secondary spiral.

Diagnosis.—Its alliance is with *T. australis*, Lam., from which, however, it differs in its more numerous and non-tuberculate spirals; from the Tasmanian variant, *T. granulifera*, Tenison-Woods, it differs in the absence of nodulation, and the relative disposition of the ribs, and of numerous spiral threadlets. It is of interest to note that neither of these forms is found in South Australian waters, though taken at Western Port, Victoria, and in Tasmania abundantly.

Type in my collection.

Turritella atkinsoni, Tate and May.

Turritella tasmanica, Tenison-Woods (*non* Reeve), Proc. Roy. Soc., Tasmania, 1877 (1876), p. 140. *Type locality*—Long Bay, Tasmania.

Turritella atkinsoni, Tate and May (*nom. mut.*), Trans. Roy. Soc., South Australia, 1900, p. 95; also Proc. Linn. Soc., New South Wales, 1901, vol. xxvi., part 3, p. 378, pl. xxiii., figs. 15, 16, and 17; Gatliff and Gabriel, Proc. Roy. Soc., Victoria, 1909, vol. xxii. (N.S.), part 1, p. 38, Bass Strait

Var. *Turritella godeffroyana*, Donald, Proc. Mal. Soc., London, 1900, vol. iv., p. 53, No. 3, pl. v., figs. 6 and 6*a*. *Type locality*—Bass Strait. Tate and May regard this shell, which Miss Donald described as a new species, as a variety of Tenison-Woods' species; and Hedley, in Memoirs Aust. Mus., 1903, vol. iv., part 6, p. 349, points out that her name has some months' priority over that of Tate and May.

Dredged in 90 fathoms off Cape Jaffa, 1; in 110 fathoms off Beachport, 2; in 130 fathoms off Cape Jaffa, 2; in 150 fathoms off Beachport, 15 good up to 16 mm. in length; in 200 fathoms off Beachport, 2 good.

Turritella atkinsoni, Tenison-Woods. *Var.* **medioangulata**, n. var Pl. xxx., figs 8 and 9.

Shell rather thin, turriculate, of twelve whorls, including a slightly mamillate blunt protoconch of two convex smooth whorls. Suture distinct, linear. Whorls medially strongly angulate and feebly carinate, sloping to both sutures, concavely to the lower, and feebly swollen midway to the upper. The first and second whorls are bicarinate, the lower carina is the rather less valid and gradually decreases to an obsolete spiral stria.

In successive whorls new striæ arise, so that in the penultimate there are three in the upper and four in the lower half of the whorl, but all obsolete. The body-whorl has a round cord-like carina forming the periphery at the suture, beyond which the base is nearly flat, slightly concave, and with numerous sublenticular spiral striæ. Aperture roundly hexagonal, with a wide effuse base; outer lip thin, roundly angled at its centre (the carina ceasing some distance from it), with a wide deep sinus having its centre at the angulation. Columella curved. Colour yellowish-brown, lighter along the suture, the earlier whorls translucent-white, tinted brownish along the angulation.

Dim. — Length, 12·9 mm.: breadth, greatest 3·6 mm., least 3 mm.

Locality.—Type in 104 fathoms 35 miles south-west of Neptune Island, with more than 80 others; in 110 fathoms off Beachport, 7 fresh, 4 poor; in 150 fathoms, 39 good; in 200 fathoms, 29 large but poor, only 2 good; in 90 fathoms off Cape Jaffa, 24 good and alive, 55 small; in 300 fathoms, 15 poor and small. It would seem, therefore, to favour 90 to 200 fathoms, and to be essentially a deep-water form. I have not taken a specimen at any less depth.

Variations.—It may reach a length of 17·75 mm. and have fourteen whorls. The angulation may be provided with a distinct carinating cord. One of the spiral striæ just behind this may also become a valid cord, and together with these, in other specimens, the peripheral spiral may appear just above the suture, with another valid spiral close behind it. These differences suggest conspecifity with *T. atkinsoni*, Tenison-Woods, although my typical shell, and the boldest-ribbed examples of his species, are very unlike. But he described his type as having "two principal keels"; *T. godeffroyana*, Donald, has three, and Tate says *T. atkinsoni* has four. The two figures drawn by Tate and May in Proc. Linn. Soc., New South Wales, *loc. cit.*, show two very dissimilar forms,

and my figure gives an extremely aberrant variety of the same species.

Type in my collection.

Strebloceras cygnicollis, Hedley.

Strebloceras cygnicollis, Hedley, Proc. Linn. Soc., New South Wales, 1904, part 1, p. 189, pl. viii., figs. 12 to 14. *Type locality*—Port Jackson. Pritchard and Gatliff, Proc. Roy. Soc., Victoria, 1906, vol. xviii. (N.S.), part 2, p. 56, recorded for Victoria.

Dredged in 55 fathoms north-west of Cape Borda, 4 alive, 1 dead.

The smooth glassy embryonic portion beyond the marked varix is not equally thin-walled throughout, but the spire and the proximal fifth are solid, and then the very thick walls gradually thin towards the varix.

Triphora tasmanica, Tenison-Woods. *Var.* **lilacina,** Verco; *var.* **aureovincta,** Verco,

This exquisitely pretty little shell was taken in perfect condition in 55 fathoms off Cape Borda.

It has a golden band like *T. regina*, Hedley, but instead of colouring the most anterior spiral of pearls, it ornaments the smooth spiral plait in front of this, and so is found in the suture and on the base of the body-whorl. Its protoconch is that of *T. tasmanica*, and has not the spicular form of *T. regina*. It is very deeply-coloured purple, like the var. *lilacina*, Verco. One example, perfect, of eight whorls, was taken.

Type in my collection.

Triphora novapostrema, n. sp. Pl. xxx., figs. 1 and 2.

Shell immature, of eight whorls, including the protoconch of two whorls, the first nearly smooth with a round projecting apex, the second with two stout prominent keels, gradually becoming nodular. In the first spire-whorl arises a faint third spiral, posterior to the others (whence the specific name), which continuously enlarges till it nearly equals them in size. They are crossed by axial liræ, about fourteen in the last whorl, both axials and spirals being well marked, the latter the stouter, and being tuberculate at their intersection. The peripheral spiral is prominent and subtuberculate, it is visible in the earlier sutures, but not in the later; two flat obsolete plaits curve round the base. Colour white.

Dim.—Length, 3·1 mm.; breadth, 1·2 mm. The largest example, immature, is 5·2 mm.

Locality.—Dredged in 55 fathoms off Cape Borda, type with 7 others, some quite fresh, all immature; in Gulf St. Vincent, 1.

Diagnosis.—Its special characters are its blunt protoconch with two carinæ, and the third spiral arising behind the others: in most *Triphora* it arises between them as in *T. angasi, tasmanica, cana*, etc.

Type in my collection.

Pyrene versicolor, Sowerby.

Columbella versicolor, Sowerby, Proc. Zool. Soc., London, 1832, p. 119. *Type locality*--Annaa, Philippine Islands (Cuming). Sowerby, Thes. Conch., vol. i, 1857, p. 117, sp. 18, pl. xxxvii., figs. 41-46; Reeve, Conch. Icon., 1858, pl. xi., figs. 51 *a* and *b*; Angas, Proc. Zool. Soc., London, 1867, p. 194, New South Wales; Tryon, Man. Conch., vol. v., 1883, p. 110, pl. xlv., figs. 84-96; (*Pyrene*) Hedley, Australasian Association for the Advancement of Science, 1909, Queensland.

Columbella scripta, Lamarck, Hist. Nat. Anim., sans Vert., ed. 2, vol. x., p. 270 (*non* Linn.).

Columbella bidentata, Menke, Moll. Nov. Holl., 1843, p. 23, No. 108; Sowerby, Thes. Conch., vol., i., 1847, p. 118, sp. 21, pl. xxxvii., figs. 53 and 54.

Columbella arenosa, Kiener; *coronata*, Duclos; *athadona*, Duclos; *tigrina*, Duclos; *aspersa*, Sowerby; *nivosa*, Reeve; *pertusa*, Reeve, are synonyms, according to Tryon (*loc. cit.*).

This species, a tropical form, appears to come some distance down the Eastern coast of Australia, but not to reach Victoria or Tasmania. It is found along the Western coast of Australia, and at Albany on the southern coast. I have a recent shell from St. Francis Island, and Dr. Torr one from Wool Bay.

At Murat Bay, in a subfossil form in a kind of conglomerate on the beach, they are found in great numbers bearing their colour markings with *Meleagrina fimbriata*, Dunker, and *Barbatia trapezia*, Deshayes, neither of which is found in our waters alive, and in the same condition they occur along the South Australian coastline to the east.

Pyrene varians, Sowerby.

Columbella varians, Sowerby, Proc. Zool. Soc., London, 1832, p. 118. *Type locality*—Gallapagos Island (Cuming). Thes. Conch., 1857, vol. i., p. 117, pl. xxxvii., figs. 47 to 50; Reeve, Conch. Icon., 1858, pl. xvii., sp. 91; Tryon, Man. Conch., vol. v., 1883, p. 110, pl. xlv., figs. 97 and 2, and pl. xlvi., figs. 3, 5, and 6, also "Philippines and New Guinea"; Hedley, Australasian Association for the Advancement of Science, Brisbane, 1909, p. 368, recorded for Queensland.

In Tate's cabinet is an example from Wauraltì, in Spencer Gulf, named and its locality certified by himself. I have not yet taken it on the South Australian coast, nor has any other collector to my knowledge.

Pyrene semiconvexa, Lamarck.

Buccinum semiconvexum, Lamarck, Hist. Nat. Anim. sans Vert., 1822, vol. vii., p. 272, no fig., locality unknown; Sowerby, Thes. Conch., vol. i., 1847, p. 127, sp. 45, pl. xxxviii., figs. 103 and 104, "Port Lincoln, Australia."

Var. *C. strigata*. Reeve, Conch. Icon., 1859, vol. xi., pl. xxv., fig. 154, locality unknown.

Var. *rosacea*, Reeve, Conch. Icon., 1859, vol. xi., pl. xxix., fig. 183, locality unknown.

Var. *Yorkensis*, Crosse, Jour. de Conch., 1865, p. 55, pl. ii., fig. 6. *Type locality*—Yorke Peninsula.

Dredged alive in 12 fathoms, and immature alive up to 22 fathoms Backstairs Passage.

There may be no markings, the shell being wholly white, or yellow, or rose-tinted, or whitish-purple, or dark-brown. There may be zig-zag axial red-brown markings throughout, or throughout the spire and just below the suture on the last whorl, the rest unicoloured. An infrasutural and a peripheral narrow articulated white-and-brown band may encircle it, the rest uniformly brown, or minutely white spotted. It may be dark-brown, almost uniformly punctuated with white; or dark-brown with a rather wide infrasutural white articulated band, and beyond this crowded spirally elongate narrow arrow-headed interrupted brown lines, forming a spiral reticulate pattern, recalling *C. dictua*, Tenison-Woods.

Pyrene austrina, Gaskoin.

Columbella austrina, Gaskoin, Proc. Zool. Soc., London, 1851, p 9. *Type locality*—Australia. Reeve, Conch. Icon., vol. xi., 1858, pl. xix., fig. 100, Australia; Tryon, Man. Conch., vol. v., 1883, p. 126, pl. xlix., fig. 99; Pritchard and Gatliff, Proc. Roy. Soc., Victoria, 1899 (1898), vol. xi., p. 198, Victoria; Tate and May, Proc. Linn. Soc., New South Wales, 1901, vol. xxvi., p. 365, Tasmania.

Dredged alive in 10 to 12 fathoms off Rapid Head, 1; and in 17 fathoms Investigator Strait, 2; occurring all along the coast; abundant and large on the shore of St. Francis Island; taken at Rottnest, Western Australia. Neither Angas nor Hedley records it for New South Wales, but it is found in Tasmania and Victoria. How far north does it extend along the Eastern and Western Australian shores?

Pyrene menkeana, Reeve.

Buccinum acuminatum, Menke (*non Col. acuminata*, Nuttall), Moll. Nov. Holl., 1843, p. 20, No. 87.

Columbella menkeana, Reeve, Conch. Icon., 1858, vol. xi., pl. xiv., figs. 69*a* and *b*. *Type locality*—Australia.

Columbella (Mitrella), Angas, Proc. Zool. Soc., London, 1865, p 166, "Gulf St. Vincent"; Tryon, Man. Conch., 1883, vol. v.,

p. 120, pl. xlviii., fig. 66; Kobelt, Conch. Cab. (Ed. Küster), Band 3, 1897, Abt. i.D, p. 110, No. 89, pl. xvi., figs 12 to 14; Pritchard and Gatliff, Proc. Roy. Soc., Victoria, 1899 (1898), vol. xi. (N.S.), part 2, p. 198, Victorian coast; Tate and May, Proc. Linn. Soc., New South Wales, 1901, vol. xxvi., part 3, p. 365, Tasmania.

Columbella xavieriana, Tenison-Woods, Proc. Roy. Soc., Tasmania, 1877 (1876), p. 134. *Type locality*—North coast, Tasmania *(Mitrella)*; Tryon, Man. Conch., 1883, vol. v., p. 137, pl. li., fig. 50; Kobelt, Conch. Cab. (Ed. Küster), 1897, Band iii., Abt. i.B, p. 213, pl. xxix., fig. 10.

Some are uniformly light-brown, with a broad infrasutural band, well defined anteriorly, articulated blackish-brown and white; the white areas may be the larger, or the brown, or both may be very narrow and numerous. The white areas may consist of white dots. In addition to the infrasutural band there may be a very distinct narrow peripheral articulated white-and-brown spiral line, its spots varying much in length. The infrasutural white areas may extend down to this line, the brown being of their usual extent, or these may reach it as well. These areas may both be continued from the suture obliquely to the extreme end of the shell, and be united in a narrow brown area behind the notch *(P. xavieriana*, T. Woods). In these last two variations the brown may be more or less completely flecked with tiny white dots. The shell may be uniformly light-brown, or very light-brown or white, with a narrow brown-black line immediately above the suture, and encircling the body-whorl, or pure white. The shell may be very pale-brown, flecked all over with white dots, and have two broad delicate purple spiral bands, one just below the centre of the spire-whorls, the other below the periphery of the body-whorl; or there may be an infrasutural narrow articulated band, then a light-brown band, then the purple band, then a peripheral brown band, then the basal purple band. This purple variety, which is an exquisitely pretty shell, I call var. *purpureocincta.*

Taken along the whole of the South Australian coastline. Dredged alive in 9 and 12 fathoms Gulf St. Vincent; 15 fathoms Point Marsden; dead in 17 fathoms Backstairs Passage, several, and in 20 fathoms; in 25 fathoms Thorny Passage, 2 fresh; in 40 fathoms off Beachport, 6 nearly bleached; none at greater depths. It is plainly a shallow-water form.

Pyrene axiaerata, n. sp. Pl. xxix., fig 4.

Shell fusiform, spire elate, apex subacute, whorls seven, feebly convex. Sutures distinct, simple. Shell immature,

Soc., London, 1867, p. 195, Port Jackson; Tryon, Man. Conch., 1883, vol. v., p. 127, pl. xlix., figs. 4 to 6; Kobelt, Conch. Cab. (Ed. Küster), 1897 (1892), Band iii., Abt. i.D, p. 106, No. 84, pl. xv., figs. 15 to 18; Adcock, Handlist Moll., South Australia, 1893, p. 5, No. 111.

Columbella nux, Reeve, Conch. Icon., 1859, vol. xi., pl. xxxv., fig. 227. *Type locality*—"Port Adelaide, New Holland"

Columbella badia, Tenison-Woods, Proc. Roy. Soc., Tasmania, 1876 (1875), p. 151. *Type locality*—"Swansea, East coast."

Columbella roblini, Tenison-Woods, Proc. Roy. Soc., Tasmania, 1876 (1875), p. 151. *Type locality*—"Storm Bay, East coast."

The colour variations are very many:—

A. Uniform dark-brown, only columella white.

B. An additional brown infrasutural line.

C. A brown infrasutural and a white peripheral line.

D. Dark-brown, spotted obscurely with white, the white columella sparsely blotched with brown.

E. Like D, but with a white-and-black articulated infrasutural line, and a peripheral spiral of white spots, varying in size and distinctness. The apex may be purplish, and the general colour purplish-brown.

F. Like D, but with axial dark-brown flames, zigzag at the periphery.

G. Like A, but with dark-brown squarish flames or blotches, extending from suture to suture, or to a little below the periphery.

H. With a white or more or less deep-brown ground colour there may be axial brown stripes straight, wavy, or becoming broken up.

Pyrene tenebrica, Reeve.

Columbella tenebrica, Reeve, Conch. Icon., 1859, vol. xi., pl. xxxi., fig. 204. *Type locality*—Unknown. (*Mitrella*). Tryon, Man. Conch., 1883, vol. v., p. 128, pl. xlix., fig. 9, Kobelt, Conch. Cab. (Ed. Küster), 1897 (1892), Band iii., Abt. i.D, p. 119, No. 99, pl. xvii., fig. 14; Pritchard and Gatliff, Proc. Roy. Soc., Victoria, 1899 (1898), vol. xi. (N.S.), part 2, p. 202, "Western Port"; Pace, Proc. Mal. Soc., London, 1902, vol. v., p. 143. [Cuming Coll., Brit. Mus., London (!).]

Taken on the beach at Port Elliot and dredged alive in 17 fathoms Backstairs Passage; identification confirmed by Mr. Gatliff.

I think this is only the variety D of *P. tenuis*, Gaskoin.

Pyrene infumata, Crosse.

Columbella infumata, Crosse, Jour. de Conch., 1863, p. 84, pl. i., fig. 3. *Type locality*—Gulf St. Vincent. Angas, Proc. Zool. Soc., London, 1865, p. 166, "Under stones and amongst weed, Salt Creek, Yorke Peninsula"; Tryon, Man. Conch., 1883, vol. v.,

p. 117, pl. xlvii., fig. 45; Kobelt, Conch. Cab. (Ed. Küster), 1897 (1892); Band iii, Abt. i.D, p. 105, No. 83, pl. xv., fig. 14; Adcock, Handlist Moll., South Australia, 1893, p. 5, No. 104.

Dredged in 7 fathoms, 1 alive; taken on Port Victor beach, typical; dredged in 9 fathoms, Port Lincoln, 1; and in Spencer Gulf, depth unrecorded, 3; taken on beach at Port MacDonnell, with an added peripheral narrow spiral line of white, dotted or continuous.

I think this is most likely only a variety of *P. tenuis*, Gaskoin.

Pyrene nubeculata, Reeve.

Columbella nubeculata, Reeve, Conch. Icon., 1859, vol. xi., pl. xxxvii., fig. 234. *Type locality*—Unknown. *(Mitrella)*, Tryon Man. Conch., 1883, vol. v., p. 140, pl. li., fig. 55; Kobelt, Conch. Cab. (Ed. Küster), 1897 (1892), Band iii, Abt. i., p. 113, No. 92, pl. xvi., fig. 18; Pritchard and Gatliff, Proc. Roy. Soc., Victoria, 1899 (1898), vol. xi. (N.S.), part 2, p. 202, Victorian coast, *(nupeculata)*, Tate and May, Proc. Linn. Soc., New South Wales, 1901, vol. xxvi., part 3, p. 366, Tasmania.

Columbella dictua, Tenison-Woods, Proc. Roy. Soc., Tasmania, 1879 (1878), pp. 34 and 35. *Type locality*—North Tasmania. *(Mitrella)*, Tryon, Man. Conch., 1883, vol. v., p. 126, pl. xlviii., fig. 96, very poor; Kobelt, Conch. Cab. (Ed Küster), 1897 (1895), Band iii., Abt. i., p. 209, No. 230, pl. xxix., fig. 1.

Columbella (Mitrella) vincta, Tate, Trans. Roy. Soc., South Australia, 1893, vol. xvii., p. 190, pl. i., fig. 11. *Type locality*—"Fowler and Streaky Bays, Middleton, and Cape Northumberland, South Australia; also North coast of Tasmania."

Pritchard and Gatliff make *C. dictua* and *C. vincta* synonyms of *C. nubeculata*, though the locality of this species is unknown. Tate and May followed them, and for the sake of uniformity I have accepted the identity. I am, however, more disposed to think that *C. saccharata*, Reeve, might have priority; in publication it has priority in place in Conch. Icon., its locality (Van Diemen Land) is suggestive, its size 13 mm., though larger than the majority of examples, is equalled by some *C. vincta*, and it corresponds in description with the translucent pink or salmon-red varieties to which Pritchard and Gatliff refer.

There are three typical colour varieties, if we exclude *C. saccharata*, Reeve, *viz.*:—the *C. dictua* form, the *Vincta* form, and a maculated form.

The *Dictua* form, with its oblique wider or narrower brown lines coalescing into long arrow-heads, may vary as follows:—

1. There may be a peripheral spiral of white spots.
2. A peripheral spiral of articulated white-and-brown spots, and another infrasutural.
3. An infrasutural spiral only of articulated white-and-brown spots.

4. A peripheral spiral of white spots, the oblique lines above this thickened at intervals to form ragged brown axial flames.

5. Purple tinted

6. A broad amber band over the lower three-fifths of the spire-whorl; a white band below this, from the level of the suture on the body-whorl; below this a somewhat fainter one on the base; the amber bands formed of very crowded oblique spiral lines.

They have been dredged in 17 to 22 fathoms in Backstairs Passage, 16 alive or in good condition; in Gulf St. Vincent and Spencer Gulf at unrecorded depths, 5 dead; and taken on the beach along the South Australian coast and on St. Francis Island. Comparatively rare.

The *Vincta* form may vary as follows:—

1. The dark band on the spire-whorls may reach the anterior suture.

2. There may be a white band between it and the suture.

3. The band may be scalloped, behind only, or in front also: the posterior white bands may be interrupted by the points of the scallops reaching the suture.

4. A second revolving broad band, generally lighter in colour, usually occurs on the front of the body-whorl, and may be quite separated from the first by a white band, or united at intervals by the points of the scallops.

5. There may be numerous axial hair lines from the band, back to the suture, and forward to the base.

6. There may be a single dark-brown band at the posterior suture, fading out anteriorly, and there may be in addition a double narrow line at the periphery. Middleton (Miss Stow).

The maculated form:—

This is the shell which was recorded in Adcock's Handlist of Aquatic Moll. of South Australia, 1893, p. 5, No. 117, as *C. Tayloriana*, Reeve, *albomaculata*, Angas; but it was a misidentification, and is a variety nearly allied to *C. vincta*, Tate.

1. It has a row of dark-brown blotches on the spire-whorls, a second row just in front of the periphery on the body-whorl, and a narrow infrasutural row of white spots. Gulf St. Vincent, (?) depth, 1 dead; Edithburgh rocks, many alive.

2. The second row of blotches may be absent. Gulf St. Vincent, (?) depth, 1 alive, 7 dead: Edithburgh rocks, alive; Venus Bay, 1; Beachport beach, 1.

3. There may be a white-and-brown peripheral spiral, and the blotches may be broken up into short spiral splashes,

or replaced by flames extending axially in a zigzag way which may be composed of narrow lines, and so approach *C. dictua*. The blotches may tend to coalesce spirally, and so approximate *C. vincta*, Tate.

This form was sent to me some time ago from North Tasmania under the name of *C. achatina*, Sowerby, the type locality of which is Swan River. (*Columbella achatina, nobis*, Sowerby, Thes. Conch., vol. i., 1847, p. 132, sp. 61, pl. xxxix., fig. 126.) The figure is 18·5 mm., and appears to be drawn of the natural size. An exactly similar shell I have from Rottnest Island, off Swan River. Reeve's figure, No. 54, pl. xii., Conch. Icon., is, however, 23·5 mm. long, and no measurement is given; so if drawn of natural size this can scarcely be identical.

Pyrene saccharata, Reeve.

Columbella saccharata, Reeve, Conch. Icon., 1859, pl. xxix., fig. 187. *Type locality*—Van Diemen's Land, Pace, Proc. Mal. Soc., London, 1892 vol. v., pp. 131 and 132.

Tryon, Man. Conch., 1883, vol. v., p. 125, makes it a synonym of *C. semiconvexa*, Lamarck, and is followed by Kobelt, Conch. Cab. (Ed. Küster), 1897 (1892), Band iii., Abt. i.D, pp. 81 and 82, No. 60.

Tate and May, Proc. Linn. Soc., New South Wales, 1901, vol. xxvi., part 3, p. 366, make it the specific name of *C. miltostoma*, Tenison-Woods, and *C. unisulcata*, Kobelt, giving Dr. Milligan's shells from Oyster Bay as the British Museum types; but Pace says these are not the types, but the Cuming Collection shells. Tate and May give a figure, *op. cit.*, pl. xxiv., fig. 19, of *C. miltostoma* as their *C. saccharata*. The description of *C. saccharata* does not apply, this has sulcations only over the base; in *C. miltostoma* they are as shown in Tate and May's figure all over the body-whorl, and especially just below the suture.

This shell is translucent and unicoloured, and may be typically pinkish; but it may be amber coloured, yellowish, or white.

It has been taken on the beach at MacDonnell Bay; in 12 fathoms off Porpoise Head, 2; in 16 fathoms off Tunk Head, 1 alive; in 17 fathoms Backstairs Passage, 9; in 20 fathoms off Newland Head, 1 alive; in Gulf St. Vincent up to 22 fathoms, 60 alive and dead; in 40 fathoms off Beachport, 1 good, dead.

The following variations may be met with in shells with the same translucence, sculpture, and shape, and link it to

Pyrene nubeculata, Reeve, of which I think it is only a variety:—

1. A whitish shell with an opaque white continuous band encircling the body-whorl from the suture.

2. Or with a spiral of white dots encircling it.

3. A white-dotted peripheral spiral, and an infrasutural spiral of narrow elongate brown spots; sometimes the brown spots are faint or invisible, and there are opaque white spots; sometimes white-and-brown spots articulate; sometimes the space between these spirals is dotted white.

4. A white-dotted peripheral spiral, and above this a spiral of larger fewer brown blotches.

5. A white-dotted peripheral spiral, above this a spiral of brown spots, and another at the suture clouding into each other between.

6. A white-spotted peripheral spiral with about twelve wavy axial brown thin flames from suture to snout.

7. A distinct dark-brown hair line at the periphery, and showing immediately above the suture, or with this hair line immediately above a white-dotted peripheral spiral, or with broad light-brown distant axial flames to the suture above, or with the peripheral hair line, and above this fine oblique *Dictua* lines up to the suture.

8. A peripheral spiral only of narrow elongate spots, appearing just above the suture in the spire.

Pyrene legrandi, Tenison-Woods.

Columbella legrandi, Tenison-Woods, Proc. Roy. Soc., Tasmania, 1876 (1875), p. 152. *Type locality*—"King's Island, Tasmania." Tryon, Man. Conch., 1883, vol. v., p. 137, pl. li., fig. 49; Kobelt, Conch. Cab. (Ed. Küster), 1897 (1895), p. 212, No. 237, pl. xxix., fig. 9; Tate and May, Proc. Linn. Soc., New South Wales, 1901, vol. xxvi., part 3, p. 367; May, Proc. Roy. Soc., Tasmania, 1902, p. 110, fig. 5, in text; Gatliff and Gabriel, Proc. Roy. Soc., Victoria, 1908, vol. xxi. (N.S.), part 1, p. 373, Victorian coast (recorded *op. cit.*, 1899, vol. xi., p. 203, as *C. brunnea*, Brazier).

The colouration is very variable. The shell may be uniformly rose-pink, brown, or white. There may be a dotted white sutural line, and a peripheral white spiral, continuous or interrupted. There may be white and amber-coloured axial flames from the suture to a white peripheral spiral band, or crowded opaque white axial narrow lines, or narrow obliquely spiral *Dictua*-like lines, either brown or opaque-white, or in an opaque white shell there may be a spiral of distant fantastic amber blotches in the spire-whorls, an amber continuous spiral above the suture, and a broad basal amber band.

Dredged in 12 fathoms Backstairs Passage, 1 fresh, 1 dead; in 17 fathoms, 3 alive, 10 dead; in 20 fathoms, 4 fresh; in 22 fathoms, 3 alive, 26 dead; in 35 fathoms off St. Francis Island, 4 immature; in 40 fathoms off Beachport, 6 dead; in 90 fathoms off Cape Jaffa, 3 dead; in 110 fathoms off Beachport, 1 very poor; in 150 fathoms, 2 dead, perfect; in 200 fathoms, 1 very poor. This seems to be a fairly deep-water form for the genus.

Pyrene attenuata, Angas.

Columbella attenuata, Angas, Proc Zool. Soc., London, 1871, p. 14, plate 1., fig. 4. *Type locality*—"Port Jackson (Brazier)." *(Atilia)*, Tryon, Man. Conch., 1883, vol. v., p. 151, pl. liii., fig 18; Kobelt, Conch. Cab. (Ed. Küster), 1897 (1896), Band iii., Abt. i., p. 220, No. 251, pl. xxx., fig. 6; Pritchard and Gatliff, Proc. Roy. Soc., Victoria, 1899 (1898), vol. xi. (N.S.), part 2, p. 203, Victorian coast; Tate and May, Proc. Linn. Soc., New South Wales, 1901, vol. xxvi., part 3, p. 365, "Pirate's Bay, Tasmania (May)"; Hedley, Memoirs Austr Mus., 1903, vol. iv., part 6, p. 377, 24 to 27 fathoms and 63 to 75 fathoms off coast of New South Wales.

Terebra beddomei, Petterd, Jour. of Conch., 1884, vol iv., p 142, No. 28. *Type locality*—"Brown's River, Tasmania"

Dredged in 24 fathoms off Newland Head, 1 poor; in 40 fathoms off Beachport, 2 poor; in 110 fathoms, 15 good and 68 poor; in 150 fathoms, 37 dead; in 200 fathoms, 8 poor; in 130 fathoms off Cape Jaffa, 10 moderate, 60 poor.

This species does not appear to inhabit our shallow waters, but to be fairly common in from 100 to 150 fathoms.

Pyrene angasi, Brazier.

Columbella interrupta, Angas (*non* Gaskoin), Proc. Zool. Soc., London, 1865, p. 56, pl. ii., figs. 9 and 10. *Type locality*—Yorke Peninsula, South Australia.

Columbella Angasi, Brazier, *op. cit.*, 1871, p. 322; *(Mitrella)*, Tryon, Man. Conch, 1883, vol. v., p. 128, pl. xlix., fig. 11; Adcock's Handlist Aquatic Moll., South Australia, 1893, p. 5, No. 113; Kobelt, Conch. Cab. (Ed. Küster), 1897 (1895), Band iii., Abt. i., p. 210, No. 233, pl. xxix., fig. 4; Pritchard and Gatliff, Proc. Roy. Soc., Victoria, 1899 (1898), vol. xi. (N.S.), part 2, p. 201, Victorian coast; Tate and May, Proc. Linn. Soc., New South Wales, 1901, vol. xxvi., part 3, p. 365, Tasmania; Hedley, Memoirs Austr. Mus., 1903, vol. iv., part 6, p. 378, 54 to 59 fathoms off Wata Mooli, New South Wales.

Columbella minuta. Tenison-Woods (*non* Gould), Proc. Roy. Soc., Tasmania, 1876 (1875), p. 152. *Type locality*—Swansea, East coast of Tasmania.

Columbella (Mitrella) tenisoni, Tryon, Man. Conch., 1883, vol. v., p., 128, pl. xlix., fig. 10, *nom. mut.* *Kobelt*, Conch. Cab. (Ed. Küster), 1897 (1895), Band iii., Abt. i., p. 210, No. 232; Pritchard and Gatliff, Proc. Roy. Soc., Victoria, 1899 (1898), vol. xi. (N.S.), part 2, p. 201, Victorian coast.

This is a most variable little species, both in shape and ornament. From single specimens several species might be created, but examination of a large number of individuals combines them all into one.

The shell may be comparatively long in the spire and narrow, or very short and broad; the whorls may be sloping and flat, or quite convex, and sometimes tumid beneath the suture, and the outer lip may be straight, or curved, or medially compressed. I have sought to separate a form which might be distinguished as *C. tenisoni*, Tryon, but without success, and have to coincide with Crosse that this species (*nom. mut.* for *C. minuta*, Tenison-Woods) is a synonym of *C. angasi*, Brazier. The colour markings have been studied very elaborately, and are described somewhat exhaustively below. I may say that the varying shapes may be found in the different groups of colour ornament, hence the impossibility of distinguishing two or more species.

The species show the following colour variations:—

A. It has a white band round the middle of the body-whorl, appearing partly above the sutures in the spire, with bold white S-shaped marks, and a spotted white spiral over the back of the canal, with brown crescents convex forwards a little below the suture, and brown axial hair lines to the base, interrupted by the peripheral white band.

B. There may be in addition a row of brown crescents convex forwards above and below the peripheral white band between the ends of the S-shaped marks.

C. There may be infrasutural brown crescents and axial brown hair lines to the base, uninterrupted by any peripheral white band.

D. There may be an articulated opaque white spiral just above the periphery, and another narrower a little below it; the space between them being translucent white, and axial brown hair lines from this to the suture above and the base below.

E. From the back of the aperture the base of the body-whorl is blackish-brown, abruptly lined above by the peripheral white spiral, and traversed below by a white spiral line just above the engraved spirals over the canal.

F. Shell white or brown or light-brown, with dark purple tips, simply pencilled axially with brown hair lines.

A second series is found with quite a distinct type of colouration, the hair lines being absent.

A. With axial brown or golden-brown narrow boomerang-shaped flames convex forwards from the suture to the periphery, and another from this over the base.

B. The flames may be wavy, with several curves in their total length.

C. With the axial flames there may be a white spiral band beneath the suture, a peripheral spiral of white spots, and a white spiral just above the revolving liræ over the canal.

D. The flames may be absent and only the three white spirals may remain.

E. Or the lower two only.

F. Or only that above the notch.

G. Or the shell may be wholly white and unornamented.

A third series consists of shells of a cinnamon-brown tint, or bluish or purplish-white. It is squat in shape, with convex-whorls slightly tumid below the suture, with a blackish-purple apex.

A. The body-whorl is ornamented throughout with three spiral rows of arrow-heads directed forwards, and formed of dark-brown rather close-set lines; the three rows are separated along two narrow spiral lines, one just above the periphery and the other from the back part of the aperture.

B. The arrow-head markings may be absent, the shell being otherwise indistinguishable.

A fourth series has two broad pale-pink spirals on the body-whorl; sometimes the upper one is broken up into large square blotches. The upper band is defined below by a narrow spiral line of white spots; these may be narrow, transversely elongate, placed obliquely, with the anterior end slightly higher than the posterior, or club-shaped, with the wider end in front; sometimes from the narrow end of these clubs directed downwards and backwards, a narrow long white spot may extend downwards and forwards.

Taken on the beach all along the coast from Beachport to St. Francis Island. Dredged in Gulf St. Vincent and Spencer Gulf, many alive and dead; in 40 fathoms off Beachport, 36, some alive; 45 fathoms off Neptune Island, 1 poor; 55 fathoms off Cape Borda, 25 good, 2 poor; 90 fathoms off Cape Jaffa, 1; 110 fathoms off Beachport, 2 good, 37 poor; 130 fathoms off Cape Jaffa, 15 very poor; 150 fathoms off Beachport, 1 poor. This species extends out into quite deep water.

Pyrene beachportensis, n. sp. Pl xxix., figs. 8 and 9.

Shell small, solid, of five whorls, including a blunt protoconch of two round smooth whorls ending abruptly. Suture linear, distinct, ascending at the aperture. Spire-whorls convex below the suture; the first two sloping towards the lower suture, the third somewhat contracted. Body-whorl large

convex, roundly contracted at the base, with a moderately long pillar.

Aperture obliquely axially rhomboidal, with a distinct gutter below the suture, outer lip swollen below the suture corresponding with the gutter, then straight or slightly impressed, anteriorly curved with a shallow infrasutural sinus in its border. Inner lip distinct, complete. Columella straight in upper half, and bent to the left in its lower. Canal open and notched.

Sculpture, slightly rude axial growth lines; eleven spirals from the labium winding round the snout.

Ornament, amber coloured, with spiral of large opaque white spots below the suture; and beneath this a narrow continuous white band, a second spiral of larger spots starting from the back of the aperture The area between the continuous band and the front of this spiral row of spots being translucent white. A dark spot on the apex.

Dim.—Length, 4 mm.; of body-whorl, 2·2 mm.; breadth, 1·8 mm.

Locality.—Type, 40 fathoms off Beachport, with 1 other; 110 fathoms off Beachport, 2; 150 fathoms off Beachport, 1.

Diagnosis.—It differs from *P. atkinsoni*, Tenison-Woods, in its blunt apex: and from *P. angasi*, of Brazier, and *P. tenisoni*, Tryon, in its swollen whorls and its large peripheral row of white spots, and especially in the bend of the canal.

Type in my collection.

Pyrene atkinsoni, Tenison-Woods.

Mangelia atkinsoni, Tenison-Woods, Proc. Roy. Soc., Tasmania, 1876 (1875), p. 141. *Type locality*—"East coast of Tasmania."

Columbella (Anachis) speciosa, Angas, Proc. Zool. Soc., London, 1877, p. 35, pl. v., fig. 3. *Type locality*—"Port Jackson." *(Seminella)*, Tryon, Man. Conch., 1883, vol. v., p. 171, pl. lvii., fig 24; Kobelt, Conch. Cab. (Ed. Küster), 1897 (1896), Band iii., Abt. i., p. 237, No. 281, pl. xxii., fig. 7; Adcock, Handlist Aquatic Moll., South Australia, 1893, p. 5, No. 119.

Columbella atkinsoni, Tenison-Woods, Pritchard and Gatliff, Proc. Roy. Soc., Victoria, 1899 (1898), vol. xi. (N.S.), part 2, p. 204, Victorian coast; Tate and May, Proc. Linn. Soc., New South Wales, 1901, vol. xxvi., part 3, p. 366.

Some examples are long and narrow, while others are short and ventricose; there may be quite valid axial ribs, or none, especially in longer individuals.

There may be a spiral row of white spots immediately below the suture. In some this may be present in the upper whorls, while the later whorls show a continuous opaque white

infrasutural spiral, with white prolongations from it on the upper ends of the axial ribs, or even all along them. A second spiral row of white spots may occur just above the suture through all the spire-whorls and above the periphery of the body-whorl, or it may disappear from the later spire-whorls and be found below the periphery of the body-whorl. The spots may be round, crescentic, or arrow-headed, directed forward. A third spiral of opaque white spots may be present just above the canal, which may also be white. There are axial wavy fine brown hair lines from the infrasutural white spiral to the canal, interrupted by the central and basal white spirals Sometimes in addition the shell has a well-marked brown colour, and all the margin of the aperture may have a shining dark-brown tint; one variant has a golden-brown spiral band a little below the infrasutural white spiral as its only ornament.

It is taken on the beach at Murat Bay and St. Francis Island in the west. It is dredged alive in 5 fathoms Gulf St. Vincent, many; 6 fathoms off St. Francis Island, several; 15 to 20 fathoms Investigator Strait, 4; 35 fathoms off St. Francis Island, several; dead in 40 fathoms off Beachport, 10 moderate, immature; 55 fathoms off Cape Borda, 62 good, short form, 7 very poor, long form: 62 fathoms off Cape Borda, 4 very poor.

Pyrene dolicha, n. sp. Pl. xxix., fig. 1.

Shell subulate of eight whorls, including a rather pointed protoconch of two smooth scarcely convex turns. Spire-whorls scarcely convex; suture distinct, subcanaliculate; body-whorl long, cylindrical, base roundly contracted; aperture narrowly oblong-oval, angulate behind, widely open in front, notched; outer lip straight, minutely swollen at the suture, scarcely impressed at its centre, effuse anteriorly; inner lip distinct, thick, erect, thickened at the suture, where it roundly joins the outer lip. Smooth, except for seven spiral liræ winding from the inner lip round the snout. Ornament, an infrasutural row of axial opaque-white spots in the upper whorls, and a brown tinting of the margin of the aperture,

Dim.—Length, 4·8 mm.; breadth, 1·4 mm.

Locality.—Gulf St. Vincent.

The type is unique; its apex and general facies and ornament are those of the smooth variety of *P. atkinsoni*, Tenison-Woods, but it is very much larger. It may be only an extreme variant.

Type in my collection.

Pyrene remoensis, Gatliff and Gabriel.

Columbella remoensis, Gatliff and Gabriel, Proc. Roy. Soc., Victoria, 1910, vol. xxiii. (N.S.), part 1, p. 82, pl. xviii., figs. 1 and 2. *Type locality*—San Remo, Western Port.

Dredged in Gulf St. Vincent, depth not recorded, 6 good, 38 dead; in 40 fathoms off Beachport, 6 moderate; in 55 fathoms off Cape Borda, 5 good, 5 poor; in 62 fathoms, 1 poor; in 110 fathoms off Beachport, 1 good, 5 poor; in 130 fathoms off Cape Jaffa, 2 poor; in 150 fathoms off Beachport, 1 poor.

To the author's description I may add that there is also an infrasutural row of tiny tubercles, due to the splitting of the row of large tubercles each into two. The ornament in the living shell consists of two translucent spiral bands, one on the spire-whorls between the large tubercles and the suprasutural, and winding round the body-whorl to the centre of the outer lip, it is edged above with a broken brown hair line, and towards the lip becomes brown; the other winds round the base and over the snout, where it is mottled and streaked with brown.

Pyrene fenestrata, n. sp. Pl. xxix., fig. 7.

Shell minute, of five whorls, including a blunt protoconch of one convex-whorl and a half, ending abruptly by a scar. Spire-whorls shouldered in the upper third; above this sloping, below this vertical. Body-whorl voluminous, shouldered, subangulate at the periphery, concavely contracted at the base. Aperture rhomboidal, contracted posteriorly; canal wide, deflected to the left; outer lip simple, thin; columella straight, feebly bidentate. Sculpture, short plicate tubercles from the suture to just beyond the shoulder, sixteen in the body-whorl; closely feebly spirally striate all over. There is a spiral row of translucent crescentic areas convex forward, just above the sutures, like windows, as though formed by grinding away the opaque outer layer of the shell, eight in the body-whorl, with the spiral striæ showing like scratches in the glass. There is a second series of them just below the periphery, becoming a broad translucent band towards the lip margin. Colour opaque-white, with a small obscure pale-brown blotch in the lower half of the lower series of windows.

Dim.—Length, 3·4 mm.; of the body-whorl, 2·4 mm.; breadth, 1·65 mm.

Locality.—Type, Venus Bay beach, 2; St. Francis Island beach, 1.

Type in my collection.

Pyrene jaffaensis, n. sp. Pl. xxix., figs. 5 and 6.

Shell cylindrically fusiform. Protoconch blunt, of one whorl and a half, subconvex, smooth, ending abruptly by a scar. Whorls four, subconvex Sutures distinct, subcanaliculate, very narrowly marginate, ascending near the aperture. Body-whorl oval, somewhat compressed at the base. Aperture oval, narrowed posteriorly; canal wide, notched; outer lip thin, simple, infrasuturally feebly excavate; columella curved, obtuse-angled at the sinistrally directed canal. Smooth, but for sublenticular minute axial and longitudinal crowded scratches.

Dim.—Length, 5·9 mm.; of body-whorl, 3·4 mm.; breadth, 2·2 mm.

Locality.—Type from 130 fathoms off Cape Jaffa, dead, with 2 others; 40 fathoms off Beachport, 1 good; 110 fathoms, 4 poor; 55 fathoms off Cape Borda, 1 moderate; 62 fathoms, 2 poor; Gulf St. Vincent, depth unrecorded, 1 alive, of a light-brown colour, protoconch darker.

Its generic location is questionable, but must be determined by future examination of the mollusc.

Type in my collection.

Pyrene plexa, Hedley.

Columbella plexa, Hedley, Proc. Linn. Soc., New South Wales, 1901, part 4, p. 702, fig. 25; *(Pyrene)*, Verco, Trans. Roy. Soc., South Australia, 1908, vol. xxxii., p. 343.

It has been taken by me also in 90 fathoms off Cape Jaffa, 2 good; in 110 fathoms off Beachport, 3 good; and in 130 fathoms off Cape Jaffa, 8 good, 7 poor.

Pyrene calva, n. sp. Pl. xxix., figs. 2 and 3.

Shell solid, of six whorls, including a protoconch of two convex smooth whorls, ending abruptly. Spire-whorls convex, sutures impressed. Body-whorl, base roundly contracted; aperture narrowly oblong-oval, pinched anteriorly into a notched canal with slightly reflected margin. Outer lip with three denticles inside its posterior third, the largest behind, and a small round shallow infrasutural sinus; inner lip a thin glaze. Sculpture bold, two spirals in the first spire-whorl, three in subsequent whorls, twelve in the body-whorl; their intersection with the axials, of which there are sixteen to eighteen in the penultimate, are tuberculate, except in the anterior four spirals on the snout, which are crossed only by oblique striæ.

Dim.—Length, 4·4 mm.; breadth, 1·7 mm.

Locality.—Type dredged in 55 fathoms north-west of Cape Borda, with 57 others, in good condition; in 6 fathoms

off St. Francis Island, 1 poor; in 10 to 15 fathoms, 1 poor; in 17 fathoms Backstairs Passage, 4 dead; in 22 fathoms, 6 fresh; in Gulf St. Vincent, below 25 fathoms, 37 dead and fresh; in 40 fathoms off Beachport, 6 good; in 45 fathoms east of Neptunes, 1 poor; in 55 fathoms off Cape Borda, 58 good; in 62 fathoms, 4 moderate; in 90 fathoms off Cape Jaffa, 13 moderate; in 104 fathoms, 35 miles south-west of Neptunes, 13 moderate; in 110 fathoms off Beachport, 1 fresh, 4 moderate; in 130 fathoms off Cape Jaffa, 1 good, 4 moderate; in 200 fathoms off Beachport, 1 very poor.

Diagnosis.—It approaches *P. gemmulifera*, Hedley, Proc. Linn. Soc., New South Wales, 1907, vol. xxxii., part 3, p. 510, pl. xix., fig. 44, but has a smooth protoconch; any axial sculpture on it, which is very rare, is only a faint striation near the upper suture, and close to the abrupt ending of the protoconch, quite different from the ribbing of Hedley's species. The spire-whorls are well rounded, and contain mostly three spirals. It is a larger species. Gatliff and Gabriel have recorded this shell for Victoria in Proc. Roy. Soc., Victoria, 1910, vol. xxiii. (N.S.), part 1, p. 89, as *Columbella gemmulifera*, Hedley, noting the differences as varietal, which I regard as specific.

Variations.—When alive the shell is translucent shining uniform light-amber colour, the protoconch rather darker, or a broad whitish band may encircle the middle of the whorls, fading out before reaching the aperture; the protoconch may be purple; generally the shell is translucent or opaque-white, probably from bleaching. Sculpture.—The axials and spirals may be well marked, but the tuberculation obsolete, giving a latticed pattern. There may be two spirals in the first spire-whorl; the back one may then split behind into a third, which gradually enlarges, and this may in the fourth whorl give off another one behind. There may rarely be three spirals in the first spire-whorl, and four in the second.

Type in my collection.

Pyrene cominellæformis, Tate.

Columbella cominellæformis, Tate, Trans. Roy. Soc., South Australia, 1892, vol. xv., p. 126, pl. 1., fig. 8. *Type locality*—Fowler Bay to Victoria. Pritchard and Gatliff, Proc. Roy. Soc., Victoria, 1899 (1898), vol. xi. (N.S.), part 2, p. 204, "Western Port"; Pace, Proc. Mal. Soc., London, 1902, vol. v., p 68.

Dredged on Yatala Shoal 6 to 10 fathoms, 1; in 15 fathoms off Middleton, 1 dead; in 22 fathoms Backstairs Passage, 1 alive, 1 dead.

Truncaria australis, Angas.

Truncaria australis, Angas, Proc. Zool. Soc., London, 1877, p. 172, pl. xxvi., fig. 5. *Type locality*—Port Jackson. Pritchard and Gatliff, Proc. Roy. Soc., Victoria, 1906, vol. xviii. (N.S), part 2, p. 44, Victorian coast.

Dredged in 40 fathoms off Beachport, 2 good, 1 poor. One of these is of bluish-pink tint.

EXPLANATION OF PLATES.

Plate XXIX.

1. *Pyrene dolicha*, Verco, n. sp.
2. ,, *calva*, Verco, n. sp.
3. ,, ,, ,, protoconch.
4. ,, *axiaerata*, Verco, n sp.
5. ,, *jaffaensis*, Verco, n. sp., side view.
6. ,, ,, ,, ventral view.
7. ,, *fenestrata*, Verco, n. sp.
8. ,, *beachportensis*, Verco, n. sp., dorsal view.
9. ,, ,, ,, mouth.

Plate XXX.

1. *Triphora novapostrema*, Verco, n. sp.
2. ,, ,, ,, protoconch.
3. *Turritella circumligata*, Verco, n. sp.
4. ,, ,, ,, protoconch.
5. ,, *mediolevis*, Verco, n. s.p.
6. ,, ,, ,, protoconch.
7. ,, *neptunensis*, Verco, n. sp.
8. ,, *medioangulata*, Verco, n. var.
9. ,, ,, ,, protoconch.

Further Notes on Australian Coleoptera, with Descriptions of New Genera and Species. No. XL.

By the Rev. Canon Blackburn, B.A.

[Read October 4, 1910.]

LAMELLICORNES.

SERICOIDES.

Heteronyx *(continued).*

Group V.

Here commences the second of the two main divisions in which I have distributed the *Heteronyces.* With the exception of a very small number of species, its members agree in the outline of the head (viewed obliquely from behind), consisting of three convex curves, the middle one being the outline of the labrum, the summit of which usually overtops the level of the clypeus. In the aberrant species the outline of the labrum appears truncate or lightly concave, which is also the case with the aberrant species of the first main division. In the aberrant species of the first division, however, the summit of the labrum does not overtop the level of the clypeus, while in those of the second main division the reverse is the case. This, no doubt, appears to be a trivial character, but I find that its adoption distributes the species affected by it much more naturally than they would be if all these aberrant species were placed in either one of the main divisions. The aberrant species of the first main division are much more numerous than those of the second.

A character of considerable value for the distinguishing of species in this Group and the remainder is to be found in the degree of separation *inter se* of the three convexities that form the "trilobed outline" of the front of the head. In some species, the middle convexity *(i.e.,* the labrum) from a certain point of view is seen to be wholly free from the lateral convexities, so that it springs from (on either side) the *base* of a lateral convexity and the outline appears as trilobed in the strict sense of the term. When that is the case I call the trilobed outline "divided." In other species the outline does not present that appearance from any point of view, but the middle convexity appears as an arch springing on either side

from slightly below the *summit* of the arch of a lateral convexity, so that the outline is seen as a trisinuate curve rather than as three separate and independent lobes. This character (the "division" of the trilobed outline) is not one that can be used with advantage to constitute primary or even secondary aggregates in a tabulation, owing to the numerous species in which the outline might be considered intermediate between the two forms; but in some instances where an already small aggregate requires subdivision, and there happen to be no species among them with the trilobed outline of intermediate form, it is of value for tabulation. I find this character to be remarkably constant and reliable within specific limits.

This Group contains fewer known species than any other, only five being attributable to it (of which two are now described as new). The two that I have placed at the beginning are closely allied *inter se*, the others all isolated forms resembling the rest and each other in little more than the structural characters that assign them to the Group. The following table differentiates the known species:—

A. Middle lobe of trilobed outline of head not or scarcely more than half each lateral lobe.	
B. Pronotum more closely punctulate	capillatus, *Macl.*
BB. Pronotum less closely punctulate	placidus, *Blackb.*
AA. Middle lobe of trilobed outline much more than half each lateral lobe.	
B. Elytra not set with long erect hairs	zalotus, *Blackb.*
BB. Elytra set with long erect hairs	
C. Elytra opaque, granulate, scarcely visibly punctulate	Lindi, *Blackb.*
CC. Elytra nitid, coarsely rugulosely punctulate	maculatus, *Blackb.*

H. placidus, sp. nov. Modice elongatus, postice leviter dilatatus; minus nitidus; castaneus; supra pilis brevibus adpressis et nonnullis erectis minus crebre vestitus; clypeo (hoc antice late leviter emarginato) fronteque crebre rugulosis, planum fere continuum formantibus; labro clypei planum vix attingenti; capite antice (a tergo oblique viso) tripliciter convexo, parte mediana quam laterales fere duplo angustiori; antennis 8-articulatis; prothorace quam longiori ut 19 ad 11 latiori, antice sat angustato, supra subfortiter minus crebre punctulato (puncturis circiter 17 in segmenti longitudine), lateribus (superne visis) sat arcuatis, angulis anticis sat acutis sat productis posticis (superne visis) sat rectis, basi bisinuata, margine basali ad latera perspicue magis elevato; elytris subgranulatis crebre subtiliter squamose punctulatis (trans elytron puncturis circiter 30); pygidio sat crebre nec profunde punctulato; coxis posticis quam metaster-

num sat brevioribus, quam segmentum ventrale 2um sat longioribus; femoribus posticis sat dilatatis; tibiis anticis extus tridentatis; tarsorum posticorum articulo basali quam 2us paullo breviori quam 3us paullo longiori; unguiculis bifidis. Long., 5 l.; lat., 2½ l.

This species is very close to *H. capillatus*, Macl., and is difficult to distinguish from it by characters suitable for tabulation. The four specimens of it before me are notably lighter in colour (perhaps variable), with the frons more coarsely rugulose, the punctures of the pronotum larger and less close (in *capillatus* there are about 22 in the length of the segment), the pronotum less convex viewed from the side, the hind coxæ less closely punctulate, the hind femora considerably more dilated.

North-West Australia; Roebuck Bay.

H. zalotus, sp. nov. Elongatus, postice vix dilatatus; minus nitidus: testaceus; supra pilis perbrevibus adpressis et nonnullis erectis sparsim vestitus; clypeo crebre ruguloso, antice late nonnihil emarginato; labro clypei planum superanti; capite antice (a tergo oblique viso) tripliciter convexo (parte mediana quam laterales vix angustiori); fronte concinne minus crebre punctulata; hac clypeoque ut plana sat disparia visis; antennis 8-articulatis; prothorace quam longiori duplo latiori, antice sat angustato, supra subtilius nec crebre punctulato (puncturis circiter 15 in segmenti longitudine), lateribus (superne visis) postice rotundato-dilatatis, angulis anticis minus acutis modice productis posticis (superne visis) rotundatis, basi haud sinuata, margine basali subtili ad latera haud magis elevato; elytris crebre subtilius punctulatis (trans elytron puncturis circiter 27); pygidio crebrius subtilius nec profunde punctulato; coxis posticis quam metasternum paullo brevioribus, quam segmentum ventrale 2um sat longioribus; tarsorum posticorum articulo basali quam 2us sat breviori quam 3us parum longiori; unguiculis bifidis. Maris segmento ventrali 5o in medio transversim carinato. Long., 3½ l.; lat., 1½ l.

An extremely isolated species of unusually narrow and elongate form. The hind coxæ, though not very much shorter than the metasternum, leave a wide strip of the 1st ventral segment exposed.

Western Australia: Swan River (Mr. Lea).

H. submetallicus, Blackb. When I described this species I expressed some doubt as to its being really distinct from *H. Lindi*, Blackb. Since that time I have seen several more specimens of both forms, and find that the colour distinctions

are not constant, and that the difference in the hind angles of the prothorax is too slight to be rightly treated as specific. The prothorax (and indeed the whole body) of *submetallicus* is a trifle broader than that of *Lindi*, and to that perhaps is due the slightly blunter appearance of the hind angles when viewed from above I am now satisfied that *submetallicus* is the female of *Lindi*.

Group VI.

The division of this Group into primary aggregates (A, AA, and AAA) is very satisfactory. All the species in A have hind coxæ either fully as long as the metasternum, or (if not quite so long) covering what I have called the 1st ventral segment (it is really the 3rd, the basal two being very short and entirely concealed under the coxæ), at least so nearly that only its linear hind edging is visible. In AA the hind coxæ are in every instance notably shorter than the metasternum. In all of them the portion of ventral segment exposed beyond their hind margin is considerably more than the mere linear hind edging. The species of AA have hind coxæ quite evidently (usually much) longer than the 2nd exposed ventral segment, but two of them are near the border line between AA and AAA, having the hind coxæ so slightly longer than the ventral segment in question that one has to give more than a passing glance before being satisfied that its place is in AA. Of these *H. tridens*, Blackb., differs notably from all those that I have placed in AAA by the very much coarser puncturation of its dorsal surface and the extremely narrow middle lobe of the trilobed outline of its head; and *H. nigellus*, Er., in AAA would stand beside *H campestris*, from which it differs by the middle lobe of the trilobed outline notably narrower, the antennæ of dark colour, etc., etc.

The character that I have used chiefly for breaking up the primary into secondary aggregates is that of the puncturation of the dorsal surface. I am not altogether satisfied with this character for the purpose, inasmuch as there are species near the border line of all the aggregates formed by its use, but I have not been able to discover any more genuinely structural distinction by which more than much smaller aggregates of species could be formed, and in dealing with so large a number of species as those contained in this Group, it is inconvenient to make the secondary aggregates numerous. Fortunately, however, the *Heteronyces* do not appear to be variable within the limits of a species in respect of puncturation. I have carefully compared—in respect of a good many species—the puncturation of numerous individuals taken in company and under circumstances that allowed no doubt of specific

identity, and have found it always the case that their punctuation was practically identical. Females are apt to be punctured a little more coarsely than males, which causes the punctures to be a little closer to each other in the former sex; but if the punctures be counted there is scarcely any variation in number. I think, therefore, that this character is of practical value for forming secondary aggregates, although I find it quite necessary to preface the tabulation with a note on each aggregate of this nature calling attention to the species which are near the border line. In the aggregate A there are no species calling for remark in this respect, no member of C approximating in puncturation to CC. In the aggregate AA, under the heading CC, I have divided the species into three sub-aggregates, according as the punctures of the pronotum are (D) very numerous and close, 10 from the front not nearly reaching the middle; (DD) moderately so, 20 or more in the whole length, 10 from the front reaching the middle; and DDD decidedly sparse, 16 or less in the whole length, 10 from the front reaching well beyond the middle. In D no species can rightly be deemed near the border line. In DD the punctures of the pronotum are perhaps a little close in *H. maurulus*, 10 from the front scarcely reaching the middle of the segment, but in all the species under D the punctures of the pronotum are very evidently much closer still. In the aggregates founded on the elytral puncturation there are few, if any, species of doubtful position. It will, however, be well to note that the position of *yilgarnensis* in the aggregate having the elytral punctures close perhaps calls for the remark that the elytral punctures of that species are a little less close than in its companions, 12 from the suture reaching not far from the middle of the elytron.

It is, perhaps, hardly necessary to remind the student that some of the characters indicated in the descriptions must not be relied upon as exactly correct for specimens other than those on which the descriptions were founded without its being borne in mind that not all the types can be depended upon to be ordinary types of fresh examples. Specimens taken, often by non-scientific collectors, in remote parts of Australia frequently occupy a long time in travel before reaching the describer, and when they reach him may have suffered more or less from abrasion and other casualties, so that by that time some characters—especially the degree of hindward dilatation of the elytra, the density of the vestiture, and the colour—may not be quite as they are in a perfectly fresh specimen.

I have made but little reference to sexual characters in the descriptions of species of this and the following Groups. The fact is that I have in almost all cases failed to discover any well-marked sexual characters at all, and even the character of the less convexity of the ventral segments in the male (which is, I think, fairly constant) is in many cases not very apparent in specimens that are not fresh and well preserved.

For the sake of clearness I may, perhaps, say that in descriptions of the basal edging of the pronotum the phrase "ad latera magis elevatus" means that the edging becomes more elevated at the ends of the basal margin than it is in other parts of its length.

The number of names (including those mentioned below as doubtful, and therefore excluded from the tabulation) of *Heteronyces* attributable to this Group hitherto published is, I believe, 37. Of these I have been able to place 32 in my tabulation. I now add 14 new species, bringing the number of identifiable species to 47 (one of which, however (*H. nigricans*, Burm.), is excluded from the tabulation for the reason mentioned below)

The following table indicates distinctive characters of the species known to me of this Group, below which will be found notes on some of the previously-described species, and then descriptions of new species:—

A. Hind coxæ as long as metasternum, or if scarcely so long at least all but covering 1st ventral segment.
  B. Joint 3 of antennæ not or scarcely shorter than joint 2.
    C. Elytral punctures not very fine and close (about 12 from suture reach to or beyond middle).
      D. Labrum (viewed from in front) strongly concave longitudinally, and not transverse ... . fervidus, *Blackb.*
      DD. Labrum (viewed from in front) an almost equilateral triangle nasutus, *Blackb.*
      DDD. Labrum (viewed from in front) very strongly transverse
        E. Labrum (viewed from in front) deeply sulcate longitudinally .. .. apertus, *Blackb.*
        EE. Labrum not as E.
          F. Hind angles of prothorax (viewed from above) strongly defined .. .. comes, *Blackb.*
          FF. Hind angles of prothorax (viewed from above) quite rounded off.
            G. Middle lobe divided from lateral lobes ... . transversicollis, *Macl.*
            GG. Middle lobe not divided from lateral lobes ... ... vicinus, *Blackb.*

CC. Elytral punctures fine and close (12 from suture not nearly reaching middle) ... . intrusus, *Blackb.*

BB. Joint 3 of antennæ much shorter than joint 2.

C. Middle lobe scarcely more than half a lateral lobe ... ... granulifer, *Blackb.*

CC. Middle lobe much more than half a lateral lobe.

D. Hind angles of prothorax (viewed from above) well defined, rectangular ... ... normalis, *Blackb.*

DD. Hind angles of prothorax (viewed from above) quite rounded off.

E. Elytra non-striate outside subsutural stria ... ... brevicornis, *Blackb.*

EE. Each elytron with 5 or 6 quite distinct striæ ... ... pygmæus, *Blackb.*

AA. Hind coxæ notably shorter than metasternum or (if less notably shorter) leaving 1st ventral segment widely exposed.

B. Middle of ventral segments opaque, with close fine asperity ... ... anceps, *Blackb.*

BB. Ventral segments not as B.

(1) C. Front face of labrum quite strongly and closely rugulose, or even granulate.

D. Elytral punctures not extremely close (20 from suture reach at least to middle).

E. Prothorax fully twice as wide as long ... ... piger, *Blackb.*

EE. Prothorax distinctly less than twice as wide as long.

F. Elytral punctures close (15 from suture not passing middle).

G. Elytra transversely thickened close to apex; therefore abruptly declivous at apex ... ... consanguineus, [*Blackb.*

GG. Elytra normal ... ... raucinasus, *Blackb.*

FF. Elytral punctures not close (15 from suture considerably pass middle) ... ... glabratus, *Er.*

DD. Elytral punctures extremely close (20 from suture not nearly reaching middle) ... ... mulwalensis, *Blackb.*

CC. Front face of labrum not rugulose, usually finely punctulate and more or less nitid.

D. Punctures of pronotum close (10 from front not very nearly reaching middle).

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(1) *H. glabratus*, Er., is somewhat intermediate in respect of this character.

E. Elytral punctures close (12 from suture do not reach middle).
  F. Elytral punctures extremely close (20 from suture not reaching middle).
    G. Joints 2 and 3 of antennæ of about equal length.
      H. Joint 4 of antennæ strongly triangular, transverse .. marcidus, *Blackb.*
      HH. Joint 4 of antennæ scarcely triangular, not transverse ... proprius, *Blackb.*
    GG. Joint 3 of antennæ very much shorter than 2 ... punctipennis, *Blackb.*
  FF. Elytral punctures less close (20 from suture pass middle strongly).
    G. Joint 4 of antennæ strongly transverse ... ... constans, *Blackb.*
    GG. Joint 4 of antennæ not or scarcely transverse.
      H. Clypeus and frons on an almost even plane . yilgarnensis, *Blackb.*
      HH. Planes of clypeus and frons very different . validus, *Blackb.*
EE. Elytral punctures not close (12 from suture reach middle) crinitus, *Blackb.*

(2) DD. Punctures of pronotum not close (about 10 from front reach or pass middle).
  E. Trilobed outline sharply divided, its middle lobe less than half a lateral lobe.
    F. Club of antennæ testaceous.
      G. Elytra strongly rugulose, in strong contrast to pronotum .. .. Sloanei, *Blackb.*
      GG. Elytra not as G.
        H. Hind coxæ considerably longer than 2nd ventral segment.
          I. Marginal edging of clypeus interrupted in middle.
            J. Joint 2 of antennæ short globular, not longer than 3 ... pinguis, *Blackb.*
            JJ. Joint 2 of antennæ not globular, distinctly longer than 3 ... . agricola, *Blackb.*
          II. Marginal edging of clypeus continuous ... auricomus, *Blackb.*
        HH. Hind coxæ very little longer than 2nd ventral segment ... ... tridens, *Blackb.*

(2) In *H. maurulus* a trifle closer.

FF. Club of antennæ dark ... nigellus, *Er (?)*

EE. Middle lobe of trilobed outline more than half a lateral lobe.

F. Elytral punctures close (12 from suture not nearly reaching middle).

G. Sides of clypeus project laterally well beyond the eyes.

H. Pronotum viewed obliquely from side has no trace of a basal angle.

I. Punctures of elytra small, scarcely larger than in *H. jubatus* ... Cunnamullæ, *Blackb.*

II. Punctures of elytra notably larger ... decorus, *Blackb.*

HH. Hind angles of prothorax (viewed obliquely from side) at least quite perceptible

I. Labrum (viewed from in front) has a well-defined erect front face distinct from the lower plane .. granulatus, *Blackb.*

II. Labrum scarcely having an erect front face distinct from lower plane . ... maurulus, *Blackb.*

GG. Sides of clypeus do not project laterally beyond the eyes ... ... cygneus, *Blackb.*

FF. Elytral punctures not close (12 from suture reach or pass the middle).

G. Punctures of pronotum not sparse (about 20 in length of segment) ... dubius, *Blackb.*

GG. Punctures of pronotum very sparse (15 or less in length of segment).

H. Basal edging of pronotum not or scarcely more raised at ends; hind angles quite rounded off.

I. Apical half at least of elytra conspicuously granulate.

J. Punctures of elytra very large and coarse ... ... crassus, *Blackb.*

JJ. Punctures of elytra notably smaller and less coarse ... ... Augustæ, *Blackb.*

II. Elytra not or scarcely granulate ... ... electus, *Blackb.*

HH. Basal edging of pronotum notably raised at ends; hind angles well marked .. .. fraserensis, *Blackb.*

AAA. Hind coxæ not longer than 2nd visible ventral segment.

B. Frons not perpendicularly declivous in front.

C. Pronotum closely punctulate (20 or more punctures in length of segment).

D. Clypeus and frons on an even continuous plane . .. .. austrinus, *Blackb.*

DD. Planes of clypeus and frons very different, latter very convex . .. . lateritius, *Blackb.*

CC. Pronotum sparsely punctulate; 15 or 16 punctures down middle line.

D. Frons quite strongly (somewhat coarsely) rugulose ... ... campestris, *Blackb.*

DD. Frons smoothly, finely, and not closely punctulate.

E. Basal edging of pronotum well defined ... . debilis, *Blackb.*

EE. Basal edging of pronotum extremely fine (scarcely distinct) ... ... jejunus, *Blackb.*

BB. Frons perpendicularly declivous at the clypeal suture ... ... dentipes, *Blackb*

H. raucinasus, Blackb. I believe that there are before me two distinct species extremely close to *raucinasus* and to each other, but as I have more than a single specimen of only one of the three, it seems better to regard them for the present as possibly varieties. The type is from South Australia, and has non-granulate elytra, with puncturation finer and notably less squamose than the other two. Of the others, one is from South Australia, and is fairly plentiful; besides the different elytral sculpture already noted its prothorax is quite evidently more transverse and less narrowed in front. The third is from the Dividing Range in Victoria, and is a little smaller than the last mentioned, with its prothorax even more narrowed in front than that of *raucinasus*.

H. constans, Blackb. This South Australian species is very close to *H. yilgarnensis*, from Western Australia. The puncturation of the dorsal surface is quite distinctly closer, especially about the apical region of the elytra; but the best distinction that I have observed is that noted in the tabulation.

H. nigellus, Er. (?). I have already pointed out and discussed the difficulty of identifying this species (Proc. Linn. Soc., N.S.W., 1889, p. 157). I am not able to throw any

fresh light upon the subject. The elytra vary in colour from black to rufous in the species which I take to be *nigellus*.

H. Augustæ, Blackb. This species forms with *crassus*, Blackb., and *electus*, Blackb., a trio of species not very easy to distinguish by characters that lend themselves to tabulation. The coarse, sparse puncturation of the elytra of *crassus* (only about 18 punctures across an elytron) is, however, very distinctive. Of the other two, *electus* is evidently the narrower and less robust, is invariably (so far as I have seen) very much lighter in colour, with prothorax less narrowed in front and less rounded on the sides, and with elytra non-granulate or with at most an accidental two or three granules, the granules of *Augustæ* being plentiful and distributed over the whole surface of the elytra.

H. nigricans, Burm. There is a specimen in the Macleay Museum at Sydney bearing this name. I examined it when I was writing my former Revision of *Heteronyx*, and thought it correctly identified. When I visited the Macleay Museum with a view to the preparation of this present memoir, I accidentally omitted to re-examine the said specimen, and as my description of it in my former Revision does not mention all the details needed to be known before the species can be placed in the tabulation of this present memoir, I am obliged to pass it by for the present, and must content myself with referring to Proc. Linn. Soc., N.S.W., 1889, pp 142 and 151, for information concerning it. It should be noted that in my former Revision (*loc. cit.*) I accidentally called this species *nigricans*, "Er.," in error.

H. obscurus, Le Guill. I have not seen the original description under this name. Burmeister states that the species is identical with *H. nigellus*, Er. The name and habitat taken together are suggestive of the statement being probably correct. The name, however, cannot stand, *H. obscurus*, Hombr. et Jacq. (Blanch.), having precedence of date.

H. spadiceus, Burm. It is probable that this is a member of Group VI. It is from the Swan River, and is described as entirely glabrous (*überall haarfrei*). I conjecture that the description was founded on a badly-abraded insect. The structure of the claws is not mentioned.

H. unicolor, Blanch. This species also probably appertains to Group VI. The want of information concerning the claws renders it possible (as in the case of the preceding species) that it is a member of Group V. It could be identified only by comparison with the type, or by means of a specimen from Tasmania agreeing with the description.

H. apertus, sp. nov. Modice elongatus, postice leviter dilatatus; modice nitidus; ferrugineus: supra pilis minus elongatis erectis minus crebre vestitus; clypeo crebre ruguloso, antice late subtruncato; labro longitudinaliter profunde late sulcato, clypei planum superanti; capite antice (a tergo oblique viso) tripliciter convexo (parte mediana quam laterales paullo angustiori); fronte sat grosse vix crebre punctulata; hac clypeoque ut plana manifeste disparia visis; antennis 8-articulatis, articulo 3° quam 2^us^ sublongiori; prothorace quam longiori ut 9 ad 5 latiori, antice leviter angustato, supra sat fortiter nec crebre punctulato (puncturis circiter 13 in segmenti longitudine), lateribus (superne visis) modice arcuatis, angulis anticis sat acutis sat productis posticis (superne visis) obtusis bene definitis, basi leviter bisinuata, margine basali latera versus magis elevato; elytris granulatis, squamose sat sparsim nec subtiliter nec profunde punctulatis (trans elytron puncturis circiter 20); pygidio crebrius minus fortiter punctulato; coxis posticis quam metasternum vix brevioribus; tarsorum posticorum articulo basali quam 2^us^ fere triplo, quam 3^us^ sat multo, breviori; unguiculis appendiculatis. Long., $4\frac{4}{5}$ l.; lat., $2\frac{3}{5}$ l.

The peculiar form of the labrum, as well as the great elongation of the second joint of the hind tarsi, renders this species easy of identification.

Western Australia; Perth, etc.

H. comes, sp. nov. Minus elongatus, postice sat dilatatus; sat nitidus; niger, antennis (harum flabello testaceo) pedibusque nonnihil rufescentibus; supra pilis brevibus pallidis adpressis sparsim vestitus; clypeo (hoc antice subtruncato) fronteque planum sat continuum præbentibus, fortiter sat æqualiter rugulosis; labro clypei planum superanti; capite antice (a tergo oblique viso) tripliciter convexo (parte mediana quam laterales sat multo angustiori); antennis 8-articulatis, articulo 3° quam 2^us^ vix breviori; prothorace quam longiori ut 8 ad 5 latiori, antice minus angustato, supra sat fortiter vix crebre punctulato (puncturis circiter 19 in segmenti longitudine), lateribus (superne visis) leviter arcuatis, angulis anticis subacutis modice productis posticis (superne visis) rectis, basi leviter bisinuata, margine basali sat æquali; elytris subrugulose subgrosse sparsius punctulatis (trans elytron puncturis circiter 17); pygidio fere ut pronotum punctulato; coxis posticis quam metasternum nonnihil brevioribus sed segmentum primum visibilem fere totum tegentibus; tarsorum posticorum

articulo basali quam 2^{us} multo, quam 3^{us} paullo, breviori: unguiculis appendiculatis. Long., 4 l.; lat., 2 l.

In some respects not unlike the species that I have regarded as being *H. nigricans*, Burm., but readily distinguishable from it by, *inter alia*, its longer hind coxæ and the much larger and less close punctures of its elytra. Each elytron has faint indications of two longitudinal costæ.

Western Australia: Albany.

H. vicinus, sp. nov. Minus elongatus, postice sat dilatatus; sat nitidus; fuscus, antennarum flabello testaceo; supra pilis pallidis minus brevibus erectis minus crebre vestitus; clypeo antice subtruncato, fortiter minus crebre ruguloso; labro clypei planum superanti: capite antice (a tergo oblique viso) tripliciter convexo (parte mediana prominenti quam laterales sat angustiori); fronte convexa sat grosse sat crebre punctulata; hac clypeoque ut plana disparia visis; antennis 8-articulatis, articulo 3^o quam 2^{us} vix breviori; prothorace quam longiori duplo latiori, antice vix angustato, supra sat grosse minus sparsim punctulato (puncturis circiter 11 in segmenti longitudine), lateribus (superne visis) sat arcuatis, angulis anticis obtusis vix productis posticis (superne visis) rotundatis, basi haud sinuata, margine basali sat æquali; elytris minute granulatis, subrugulose sat grosse nec crebre punctulatis (trans elytron puncturis circiter 16); pygidio sparsius nec subtiliter punctulato: coxis posticis metasterno longitudine sat æqualibus; tarsorum posticorum articulo basali quam 2^{us} paullo breviori, quam 3^{us} sublongiori; unguiculis appendiculatis, parte basali ad apicem spiniformi. Long., $2\frac{4}{5}$ l.; lat., $1\frac{2}{5}$ l.

This very small species has much the appearance to a casual glance of a dwarf *H. transversicollis*. Macl., but differs from it also by, *inter alia*, the very much wider and more prominent middle lobe (labrum) of the trilobed outline of its head (in *transversicollis* not more than half a lateral lobe) and the closer puncturation of its elytra.

South Australia; near Adelaide (Mr. Griffith).

H. intrusus, sp. nov. Minus elongatus, postice sat dilatatus; minus nitidus; ferrugineus; supra pilis brevibus adpressis sat crebre vestitus; clypeo fortiter ruguloso, antice subtruncato; labro clypei planum superanti; capite antice (a tergo oblique viso) tripliciter convexo (parte mediana quam laterales sat angustiori); fronte fortiter rugulose sat crebre punctulata; hac clypeoque ut plana paullo disparia visis; antennis 8-articulatis,

articulo 3o quam 2us vix breviori; prothorace quam longiori ut 7 ad 4 latiori, antice parum angustato, supra minus fortiter subcrebre punctulato (puncturis circiter 16 in segmenti longitudine), lateribus (superne visis) sat arcuatis, angulis anticis sat acutis minus productis posticis (superne visis) rectis, basi sat fortiter bisinuata, margine basali ad latera magis elevato; elytris crebre subtilius punctulatis (trans elytron puncturis circiter 30); pygidio sat fortiter sparsius punctulato, longitudinaliter in parte antica leviter carinato; coxis posticis quam metasternum vix brevioribus; tarsorum posticorum articulo basali quam 2us duplo, quam 3us sat multo, breviori; unguiculis appendiculatis. Long., $3\frac{3}{5}$ l.; lat., $1\frac{4}{5}$ l.

Very easily distinguishable from all the species to which it is structurally a close ally by the much finer and close puncturation of its elytra. The trilobed outline of the head is divided, but not strongly; the middle lobe has about two-thirds the span of a lateral lobe.

Western Australia; Perth (Mr. Lea).

H. pygmæus, sp. nov. Minus elongatus, postice parum dilatatus; minus nitidus; rufescens, elytris pallidioribus; supra pilis sat brevibus adpressis sat crebre vestitus; clypeo sat crebre sat grosse ruguloso, antice subtruncato; labro clypei planum superanti; capite antice (a tergo oblique viso) tripliciter convexo (parte mediana quam laterales parum angustiori); fronte subrugulose sat fortiter sat crebre punctulata; hac clypeoque ut plana paullo disparia visis; antennis 8-articulatis brevissimis, articulo 3o quam 2us multo breviori; prothorace quam longiori ut 12 ad 7 latiori, antice minus angustato, supra subtiliter sat crebre punctulato (puncturis circiter 19 in segmenti longitudine), lateribus (superne visis) fortiter rotundatis pone medium manifeste dilatatis, angulis anticis obtusis vix productis posticis (superne visis) obtuse rotundatis, basi haud sinuata, margine basali subtili æquali; elytris manifeste substriatis, crebre subtiliter punctulatis (trans elytron puncturis circiter 30); pygidio subtilius minus crebre punctulato; coxis posticis quam metasternum haud brevioribus; tarsorum posticorum articulo basali quam 2us vix breviori, quam 3us paullo longiori; unguiculis appendiculatis. Long., $2\frac{1}{2}$ l.; lat., $1\frac{1}{4}$ l.

This very small species is closely allied to *H. brevicornis*, Blackb., from which, however, it is easily distinguishable by, *inter alia*, its elytra very evidently substriate. The trilobed

outline of the head is divided, but not very conspicuously, the middle lobe prominent and nearly as wide as a lateral lobe.

Western Australia; Yilgarn (Mr. French).

H. proprius, sp. nov. Modice elongatus, postice parum dilatatus; minus nitidus; ferrugineus; supra pilis brevibus adpressis sat crebre vestitus; clypeo sat crebre ruguloso, antice leviter emarginato; labro clypei planum superanti; capite antice (a tergo oblique viso) tripliciter convexo (parte mediana quam laterales sat angustiori); fronte fortiter sat crebre vix rugulose punctulata; hac clypeoque ut plana sat disparia visis; antennis 8-articulatis, articulo 3^{o} quam 2^{us} et quam 4^{us} paullo breviori; prothorace quam longiori ut 9 ad 5 latiori, antice sat angustato, supra crebre subtilius punctulato (puncturis circiter 25 in segmenti longitudine), lateribus (superne visis) modice arcuatis, angulis anticis minus acutis minus productis posticis (superne visis) rotundato-obtusis, basi leviter bisinuata, margine basali latera versus magis elevato; elytris crebre subtilius punctulatis (trans elytron puncturis circiter 32), minute plus minusve crebre granulatis; pygidio sat crebre minus subtiliter punctulato; coxis posticis quam metasternum sat brevioribus quam segmentum ventrale 2^{um} sat longioribus; tarsorum posticorum articulo basali quam 2^{us} sat multo quam 3^{us} paullo vel vix breviori: unguiculis appendiculatis. Long., $4\frac{3}{5}$ l.; lat., $2\ ^{3}$ l. (vix.).

Among the species of this Group with hind coxæ of intermediate length, the front face of the labrum nitid and finely punctulate, and the pronotum and elytra closely punctulate, this species is easily distinguishable by the antennal characters indicated in the tabulation. The fourth joint of the antennæ longer than the third is an unusual character. The trilobed outline of the head is feebly developed and not divided, the middle lobe about two-thirds of a lateral lobe.

Western Australia; Perth, etc. (Mr. Lea).

H. validus, sp. nov. Minus elongatus, postice sat dilatatus; sat nitidus; obscure ferrugineus, antennis dilutioribus; supra pilis brevibus adpressis minus crebre vestitus; clypeo crebre minus fortiter ruguloso, antice late emarginato; labro clypei planum superanti; capite antice (a tergo oblique viso) tripliciter convexo (parte mediana quam laterales multo angustiori); fronte crebre rugulose sat fortiter punctulata; hac clypeoque ut plana valde disparia visis; antennis 8-articulatis, articulo 3^{o} quam 2^{us} vix breviori; prothorace quam longiori ut 9 ad 5 latiori, antice sat angustato, supra crebre minus fortiter

punctulato (puncturis circiter 24 in segmenti longitudine), lateribus (superne visis) sat arcuatis, angulis anticis sat acutis minus productis posticis (superne visis) obtusis, basi nonnihil bisinuata, margine basali latera versus magis elevato; elytris sat crebre minus fortiter punctulatis (trans elytron puncturis circiter 30); pygidio longitudinaliter subcarinato, sat crebre subtilius leviter puctulato; coxis posticis quam metasternum sat brevioribus quam segmentum ventrale 2um sat longioribus; tarsorum posticorum articulo basali quam 2us sat multo breviori quam 3us sublongiori; unguiculis appendiculatis. Long., $4\frac{2}{5}$ l.; lat., $2\frac{1}{5}$ l.

Rather near to *H. yilgarnensis*, Blackb., but, *inter alia*, notably smaller, with the head very different, elytral sculpture smoother, basal joint of hind tarsi shorter in proportion to second joint. The trilobed outline of the head is well defined, divided; the middle lobe not more projecting than the lateral lobes, and scarcely larger than half a lateral lobe.

Victoria (Mr. Griffith).

H. crinitus, sp. nov Modice elongatus, postice parum dilatatus; modice nitidus; niger, antennis pedibusque piceis; supra capillis elongatis fulvis erectis sat crebre vestitus; clypeo (hoc antice leviter emarginato) fronteque confertim subtilius rugulosis, ut plana sat disparia visis; labro clypei planum superanti; capite antice (a tergo oblique viso) tripliciter convexo (parte mediana quam laterales sat multo angustiori); antennis 8-articulatis, articulo 3o quam 2us sat multo breviori; prothorace quam longiori ut 5 ad 3 latiori, antice minus angustato, supra crebre minus fortiter punctulato (puncturis circiter 24 in segmenti longitudine), lateribus (superne visis) modice arcuatis, angulis anticis minus acutis minus productis posticis (superne visis) obtuse rectis, basi leviter bisinuata, margine basali sat æquali; elytris obsolete substriatis, sat fortiter minus crebre nonnihil rugulose punctulatis (trans elytron puncturis circiter 20); pygidio crebre minus fortiter punctulato; coxis posticis quam metasternum sat brevioribus, quam segmentum ventrale 2um sat longioribus; tarsorum posticorum articulo basali quam 2us sat multo breviori, 3o sat æquali; unguiculis appendiculatis. Long., $4\frac{1}{2}$ l.; lat., $2\frac{1}{5}$ l.

Easily distinguishable from all near allies by colour and vestiture. The puncturation of the pronotum much finer and closer than of the elytra also furnishes a conspicuous character.

Tasmania; Mount Wellington (Mr. Griffith).

H. agricola, sp. nov. Minus elongatus, postice leviter dilatatus; sat nitidus; obscure ferrugineus; supra pilis brevibus adpressis minus crebre vestitus; clypeo (hoc antice emarginato) fronteque crebre minus fortiter rugulosis, ut plana manifeste disparia visis; labro clypei planum superanti; capite antice (a tergo oblique viso) tripliciter convexo (parte mediana quam lateralium dimidium angustiori); antennis 8-articulatis, articulo 3° quam 2us parum breviori; prothorace quam longiori ut 11 ad 6 latiori, antice sat angustata, supra minus crebre minus fortiter punctulato (puncturis circiter 20 in segmenti longitudine), lateribus (superne visis) leviter arcuatis, angulis anticis sat acutis sat productis posticis (superne visis) subrectis, basi bisinuata, margine basali ad latera paullo magis elevato; elytris minus crebre vix fortiter plus minusve squamose punctulatis (trans elytron puncturis circiter 25); pygidio crebrius subtiliter punctulato, longitudinaliter nonnihil subcarinato; coxis posticis quam metasternum sat brevioribus quam segmentum ventrale 2um sat longioribus; tarsorum posticorum articulo basali quam 2us sat breviori, 3° sat æquali; unguiculis appendiculatis. Long., 5½-6 l.; lat., 2⅝-3 l.

The form of the trilobed outline of the head renders this species very easy to distinguish from almost all to which it bears any notable general resemblance. It is nearest to *H. pinguis*, Blackb., which has a similar trilobed outline of the head and a similar clypeus; but *pinguis* differs from it by numerous characters, especially the antennal structure (which seems to furnish the most convenient character for tabulation), the head notably smaller in proportion to the prothorax, colour much darker, form notably more depressed with more hindward dilatation, elytral puncturation not at all of the squamose type, clypeus and frons notably less near to forming an even plane. Compared with *H. agricola*, Blackb., *H. auricomus*, Blackb., is much smaller, its colour much lighter, its clypeus with a continuous raised edging across the front, etc. The trilobed outline of the head in *agricola* is fairly strongly defined, though notably less so than in *H. Sloanei*, Blackb., and is divided, with the middle lobe slightly less than half a lateral lobe. *Sloanei* is easily distinguished from *agricola* by its strongly rugulose elytra, etc.

New South Wales; Emu Plains (Mr. Sloane).

H. Cunnamullæ, sp. nov. Modice elongatus, postice nonnihil dilatatus; sat nitidus; ferrugineus; supra pilis brevibus adpressis minus crebre vestitus; clypeo crebre minus

fortiter ruguloso, antice leviter emarginato; labro clypei planum superanti; capite antice (a tergo oblique viso) tripliciter convexo (parte mediana quam lateralium dimidium paullo latiori); fronte crebre fortius ruguloso-punctulata; hac clypeoque ut plana sat disparia visis; antennis 8-articulatis, articulo 3o quam 2us sat breviori; prothorace quam longiori ut 20 ad 11 latiori, antice sat fortiter angustato, fortius minus crebre punctulato (puncturis circiter 18 in segmenti longitudine), lateribus (superne visis) sat arcuatis pone medium nonnihil dilatato-rotundatis, angulis anticis sat acutis minus productis posticis (superne visis) rotundato-obtusis, basi leviter bisinuata, margine basali sat æquali; elytris crebre minus fortiter sat squamose punctulatis (trans elytron puncturis circiter 30), pygidio minus fortiter sat crebre punctulato; coxis posticis quam metasternum sat brevioribus quam segmentum ventrale 2um sat longioribus; tarsorum posticorum articulo basali quam 2us sat breviori, 3o sat æquali; unguiculis appendiculatis. Long., 5 l.; lat., $2\frac{1}{10}$ l.

Although the hind angles of the prothorax when viewed from directly above the segment appear (owing to the convexity of the segment concealing the true margin) to be not quite rounded off, yet when looked at a little from the side obliquely (so that the true margin is seen) they cease to be traceable, and are an even curve with no definite place of meeting of the base and lateral margin. That is not the case with any other of the near allies of this species except *decorus*, Blackb., which, however, is a larger, broader, and more robust insect, with the punctures of the elytra notably larger. The trilobed outline of the head of this species is well developed and divided (but not very strongly), the middle lobe about two-thirds of a lateral lobe.

Queensland; Cunnamulla (Mr. Lea).

H. granulatus, sp. nov. Minus elongatus, postice modice dilatatus; sat nitidus; obscure ferrugineus; supra pilis brevibus adpressis sat sparsim vestitus; clypeo (hoc antice subtruncato) fronteque crebre sat fortiter rugulosis; labro clypei planum superanti; capite antice (a tergo oblique viso) tripliciter convexo (parte mediana quam laterales sat angustiori); antennis 8-articulatis, articulo 3o quam 2us paullo breviori; prothorace quam longiori ut 14 ad 8 latiori, antice modice angustato, supra fortius minus crebre punctulato (puncturis circiter 20 in segmenti longitudine), lateribus (superne visis) leviter arcuatis, angulis anticis sat acutis modice productis posticis (superne visis)

sat acute rectis, basi sat fortiter bisinuata, margine basali ad latera summa paullo magis elevato; elytris crebre minus fortiter squamose punctulatis (trans elytron puncturis circiter 30), granulis minutis nitidis permultis instructis; pygidio longitudinaliter subcarinato crebre subtilius punctulato; coxis posticis quam metasternum sat brevioribus quam segmentum ventrale 2um sat longioribus; tarsorum posticorum articulo basali quam 2us paullo breviori, 3o subæquali; unguiculis appendiculatis. Long., $4\frac{2}{5}$ l.; lat., $2\frac{3}{10}$ l.

Resembles *Cunnamullæ*, Blackb., in general appearance, but can be readily distinguished from it by the difference in the form of the prothorax (already discussed under *Cunnamullæ)*. The trilobed outline of the head is feebly developed, scarcely divided; the middle lobe about two-thirds of a lateral lobe. The puncturation of the elytra becomes very fine and close near the apex.

New South Wales; Sydney, Galston, Blue Mountains.

H. maurulus, sp. nov. Modice elongatus, postice vix dilatatus; minus nitidus; niger, elytris piceis, palpis antennis tarsisque rufescentibus; supra pilis brevibus adpressis vestitus; clypeo crebre ruguloso, antice emarginato; labro clypei planum superanti, toto longitudinaliter concavo; capite antice (a tergo oblique viso) tripliciter convexo (parte mediana quam laterales paullo angustiori); fronte crebre fortiter ruguloso-punctulata; hac clypeoque ut plana minus disparia visis; antennis 8-articulatis, articulo 3o quam 2us parum breviori; prothorace quam longiori ut 9 ad 5 latiori, antice sat angustato, minus fortiter vix crebre punctulato (puncturis circiter 21 in segmenti longitudine), lateribus (superne visis) modice arcuatis, angulis anticis minus acutis minus productis posticis (superne visis) rectis nonnihil retrorsum productis, basi bisinuata, margine basali sat æquali; elytris nonnihil substriatis, crebre subtilius aspere punctulatis (trans elytron puncturis circiter 30); pygidio sparsius subtilius punctulato; coxis posticis quam metasternum sat brevioribus quam segmentum ventrale 2um sat longioribus; tarsorum posticorum articulo basali quam 2us sat breviori quam 3us sat longiori; unguiculis appendiculatis. Long., 4 l.; lat., 2 l.

A very distinctive character of this species is found in the shape of the labrum, which does not appear to have an erect plane (distinct from a lower plane sloping away more or less horizontally hindward from the lower edge of the erect plane). In most *Heteronyces*, of Groups V.-VIII. *(e.g., H. elongatus*, Blanch., of this memoir), the erect plane of the

labrum is conspicuously present. *H. jubatus*, Blackb., is a species having no trace of the erect plane. In the present species the labrum is of the *jubatus* type, but not quite absolutely, as from a certain point of view there is the appearance of an extremely narrow upturned edging, which, on close inspection, is seen to be not really erect. The trilobed outline of the head is feebly developed and scarcely divided, the middle lobe a little more than two-thirds of a lateral lobe. The punctures of the pronotum are a trifle closer than in the immediately allied species (10 from the front scarcely reaching the middle of the segment), but the species could not be placed in the aggregate with pronotum closely punctured, in all of which 10 punctures from the front fall decidedly short of reaching the middle.

Victoria.

H. austrinus, sp. nov. Modice elongatus, postice sat dilatatus; sat nitidus; ferrugineus; supra pilis brevibus adpressis minus crebre vestitus; clypeo (hoc antice late vix emarginato) fronteque crebre rugulosis, fere ut planum continuum visis; labro clypei planum superanti; capite antice (a tergo oblique viso) tripliciter convexo (parte mediana quam lateralium dimidium paullo latiori); antennis 8-articulatis, articulo 3^o quam 2^{us} sublongiori; prothorace quam longiori ut 8 ad 5 latiori, antice parum angustato; supra crebre sat subtiliter punctulato (puncturis circiter 27 in segmenti longitudine), lateribus (superne visis) sat arcuatis pone medium nonnihil ampliato-rotundatis, angulis anticis sat acutis modice productis posticis (superne visis) obtusis, basi leviter bisinuata, margine basali ad latera summa nonnihil magis elevato; elytris crebre minus fortiter punctulatis (trans elytron puncturis circiter 30); coxis posticis quam metasternum multo brevioribus, quam segmentum ventrale 2^{um} vix longioribus; tarsorum posticorum articulo basali quam 2^{us} sat multo, quam 3^{us} paullo, breviori; unguiculis appendiculatis. Long., $4\frac{2}{5}$ l.; lat., $2\frac{1}{5}$ l.

The unusually short hind coxæ furnish a distinctive character for this species among most of the *Heteronyces* of this Group. From *H. lateritius*, Blackb. (which stands beside it in my tabulation), it may be readily distinguished by its prothorax being scarcely narrower in front than at the base as well as by the character cited in the tabulation. The trilobed outline of its head is fairly well developed but not distinctly divided, the middle lobe well projected, and a little less in size than two-thirds of a lateral lobe.

Western Australia; Swan River.

H. campestris, sp. nov. Modice elongatus, postice sat dilatatus; sat nitidus; ferrugineus; supra pilis sat brevibus adpressis minus sparsim vestitus; clypeo crebre ruguloso, antice late leviter emarginato: labro clypei planum superanti; capite antice (a tergo oblique viso) tripliciter convexo (parte mediana quam laterales sat angustiori); fronte crebre rugulose punctulata; hac clypeoque ut plana sat disparia visis; antennis 8-articulatis, articulo 3^{o} quam 2^{us} sublongiori; prothorace quam longiori ut 24 ad 13 latiori, antice minus angustato, supra minus crebre sat fortiter punctulato (puncturis circiter 16 in segmenti longitudine), lateribus (superne visis) leviter arcuatis, angulis anticis sat acutis minus productis posticis (superne visis) subrectis, basi leviter bisinuata, margine basali ad latera vix magis elevato; elytris subfortiter sat crebre granulatim punctulatis (trans elytron puncturis circiter 28); pygidio crebre subtilius punctulato; coxis posticis quam metasternum multo brevioribus quam segmentum ventrale 2^{um} vix longioribus; tarsorum posticorum articulo basali quam 2^{us} paullo breviori quam 3^{us} paullo longiori; unguiculis appendiculatis. Long., 4 l.; lat., 2 l.

This species bears a general resemblance to *H. granulatus*, Blackb. It is, however, easily distinguishable from that species by its notably shorter hind coxæ, its pronotum notably less narrowed in front, punctures of dorsal surface evidently larger and less close. The trilobed outline of its head is well defined and divided, the middle lobe about two-thirds of a lateral lobe. The labrum presents the very unusual character of the upper (arched) outline of the erect front face, as viewed from in front, being finely margined.

New South Wales; Sydney.

Group VII.

Since this Group and the next both contain numerous species which are assigned to either Group, according as their hind claws are bifid or appendiculate, and as there are undoubtedly degrees of bifidity and appendiculation, some species being either strongly or feebly bifid or appendiculate, it is, of course, obvious that in dealing with these Groups very particular attention must be paid to the claws. I do not think that there are any species in either Group whose claw-structure would be likely on careful examination to be mistaken for that of the other Group. Nevertheless, it is possible that an observer whose eye was not trained by lengthy study of these insects might feel some hesitation in confidently

assigning to their Group a few of those whose claw-structure is nearest to the border line. It is, perhaps, well, therefore, to repeat here the definitions of bifid and appendiculate claws with special application to the requirements of identification in these particular Groups A typically bifid claw, then, is one in which the basal piece is conspicuously produced at its inner apex into a process more or less perpendicular to the axis of the claw, which process is at least half as large as the process of the apical piece, the whole basal piece being on the external margin much longer than (usually about twice as long as) the apical piece. A typically appendiculate claw is not produced at the inner apex of the basal piece, or is produced into a minute process much less than half as large as the process of the apical piece and very much more slender, the whole basal piece being on the external margin not much longer than the apical piece. Near the border line (in respect of the claws) of Group VIII. are a few species in which the apical piece of the (hind) claws is larger than normal, or the process of the basal piece is scarcely half as large as that of the apical piece. In these possibly doubtful species one at least of the following characters is present in the claws, and is not present in those of any possibly doubtful species of Group VIII.:—*(a)* The process of the basal piece a wide triangular tooth-like projection, or truncate at its apex (as distinguished from the apex of the whole basal piece); *(b)* the intermediate or front claws (or both of them) notably more typically bifid than the hind claws. The species with hind claws least pronouncedly bifid are, perhaps, *ignobilis*, Blackb.; *neglectus*, Blackb.; *lucidus*, Blackb.; *aridus*, Blackb.; and *diversiceps*, Blackb., but I do not think anyone would find any real difficulty even with them.

It must be noticed that in order to determine the form of the claw it is necessary to look at it with its compressed surface levelly opposite the eye. Viewed with the outer margin in that position many appendiculate claws appear simple, which, I have no doubt, accounts for the statement of Lacordaire and others that some *Heteronyces* have simple hind claws. Viewed obliquely from in front, so that the apical piece appears foreshortened, some appendiculate claws seem to be bifid.

A remark seems desirable on a character occasionally made use of in the tabulation of this and the next Group, *viz.*, the lateral projection of the clypeus, which is not a mere matter of degree, for where it passes the outline of the eye, as in the majority of *Heteronyces* it does, it is (I think invariably) of more or less angular form, whereas in those species where it does not pass the outline of the eye there is no angulation.

In this Group I have made little or no use of the comparative length, *inter se*, of the antennal joints, having not found sufficient variation in that respect to call for special remark, and in not a few species the antennal joints of the stipes are very short, and are difficult to examine without dissection.

External tridentation of the front tibiæ is so nearly a generic character in *Heteronyx* that I have not burdened my descriptions with a statement of the number of external teeth on the front tibiæ where that number is three.

The number of names of previously-described species clearly attributable (through either definiteness of description or my inspection of the type) to this Group is 20. One of these (*H. pellucidus*, Burm.) I have not been able to recognize among the *Heteronyces* known to me; it ought to be easily identified, as will appear on reference to my note concerning it (*vide infra*). Another of them (*H. subvittatus*, Macl., also noted below) is a synonym. I describe 14 new species in the following pages, bringing the number confidently attributable to the Group up to 33, one of them being omitted from the tabulation for the reason stated above. Besides these 33 there are 9 names of *Heteronyces* which (judged by the descriptions) probably appertain to either this or the next Group, but cannot be placed definitely without inspection of the types—presumably in Europe—in either Group, because the structure of the claws is not mentioned in the descriptions. It is quite likely that I may redescribe some of these, but as I have not access to the types I must run that risk. They will be enumerated in the supplement.

The following table indicates distinctive characters of the species known to me in this Group, below which will be found notes on some of the previously-described species, and then descriptions of the new species:—

A. Flabellum of antennæ testaceous or brightly ferruginous.
  B. Hind coxæ about same length as metasternum covering (or all but) 1st ventral segment.
    C. Middle lobe of trilobed outline not more than half a lateral lobe.
      D. Hind claws strongly bifid, apical process not or scarcely longer than hinder process.
        E. Elytral punctures very close (20 from suture scarcely passing middle) ... ... sollicitus, *Blackb.*
        EE. Elytral punctures not very close (20 from suture passing middle strongly).

F. Clypeus and frons form an almost continuous surface almost on one plane ... .. Darwini, *Blackb.*

FF. Clypeus and frons very distinct; the latter separately convex .. .. sequens, *Blackb.*

DD. Hind claws feebly bifid, apical process much longer than hinder process . .. . ignobilis, *Blackb.*

CC. Middle lobe of trilobed outline much wider.

D. Prothorax fully twice as wide as long.

E. Trilobed outline strongly divided ... ... rhinoceros, *Blackb.*

EE. Trilobed outline not or scarcely divided.

F. Punctures of elytra very fine and close (20 from suture not passing middle) bidentatus, *Blackb.*

FF. Punctures of elytra notably less fine and close (20 from suture pass middle strongly).

G. Front tibiæ with only two external teeth .. ... infirmus, *Blackb.*

GG. Front tibiæ with three external teeth.

H. Clypeal suture strongly angular; size moderate (about 3½ l.) .. ... viduus, *Blackb.*

HH. Clypeal suture gently arched; size very small (about 2½ l.) ... pauxillus, *Blackb.*

DD. Prothorax distinctly less than twice as wide as long.

E. Clypeus and frons almost form a continuous plane; frons coarsely punctured.

F. Clypeus projects laterally on either side beyond outline of eye ... ... incola, *Blackb.*

FF. Clypeus not projecting beyond outline of eye ... ... neglectus, *Blackb.*

EE. Planes of clypeus and frons very different; frons strongly convex, not coarsely punctured.

F. Elytra non-striate, nitid ... modestus, *Blackb.*

FF. Elytra conspicuously striate, subopaque .. .. aridus, *Blackb.*

BB. Hind coxæ considerably shorter than metasternum (a wide strip of 1st ventral segment exposed).

C. Lateral margin of pronotum conspicuously expanded (and its raised edging accentuated) close to front angles.

D. Trilobed outline divided, strongly developed.
  E. Hind angles of prothorax quite sharply rectangular .. ... rectangulus, *Blackb.*
  EE. Hind angles of prothorax (from all points of view) obtuse or rounded off ... ... disjectus, *Blackb.*
DD. Trilobed outline very feeble, not divided.
  E. Pronotum sparsely punctured (not more than 14 punctures in the length).
    F. Sides of prothorax well rounded (not less so than in *H. jubatus*)
      G. Labrum (viewed from in front) with a well-defined erect front face (resembling that of *H. elongatus*) infuscatus, *Macl.*
      GG. Labrum not having a distinct erect front face rotundifrons, *Blackb.*
    FF. Sides of prothorax scarcely rounded (greatest width across base).
      G. External teeth of front tibiæ very feeble and blunt ... . lucidus, *Blackb.*
      GG. External teeth of front tibiæ strong and acute ... fictus, *Blackb.*
  EE. Pronotum much more closely punctured (about 20 fine punctures in length) .. ... cribriceps, *Blackb.*
CC. Lateral margin of pronotum not expanded in front.
  D. Middle lobe of trilobed outline rounded.
    E. Punctures of pronotum numerous (at least 20 in the length).
      F. Elytral punctures moderate (15 from suture passing middle).
        G. Prothorax but little narrowed in front.
          H. Sides of prothorax lightly arched ... ... borealis, *Blackb.*
          HH. Sides of prothorax strongly rounded ... pauper, *Blackb.*
        GG. Prothorax very strongly narrowed in front ... ... sordidus, *Blackb.*
      FF. Elytral punctures extremely fine and close (15 from suture not reaching middle) subfuscus, *Macl.*
    EE. Punctures of pronotum notably less numerous.
      F. Tilobed outline strongly developed, strongly divided, middle lobe less than half a lateral lobe ... ... humilis, *Blackb.*

FF. Trilobed outline not as F.
G. Frons closely and rugulosely sculptured; prothorax considerably narrowed in front.
H. Size moderate ($3\frac{1}{2}$ l. or more).
I. Elytral punctures sparse (10 from suture reach middle) . sparsus, *Blackb.*
II. Elytral punctures much more numerous cliens, *Blackb.*
HH. Size very small ($2\frac{1}{2}$ l. or less) ... ... lividus, *Blackb.*
GG. Frons smoothly, coarsely and not closely punctured: base and front of prothorax scarcely different in width .. .. diversiceps, *Blackb.*
DD. Middle lobe of trilobed outline quite sharply angular ... ... acutifrons, *Blackb.*
AA. Flabellum of antennæ dark (black or nearly so).
B. Dorsal surface subopaque, punctures very lightly impressed, elytra with conspicuous obtuse costæ . . . . potens, *Blackb.*
BB Not as B.
C. Lateral margin of pronotum widely expanded close to the front angles .. . . . . incultus, *Blackb.*
CC. Lateral margin of pronotum even aphodioides, *Blanch.*

H. Darwini, Blackb. In the description of this species (Proc. Linn. Soc., N.S.W., 1889, p. 435) I called the tooth-like projection of the inner apex of the hind femora "strong but not sharp." This would be better expressed "strong but not very sharp," the projection being, as a fact, quite evidently sharper than in almost any other *Heteronyx* known to me; it is usually feeble and blunt.

H. sequens, Blackb This species is somewhat close to *H. sollicitus*, Blackb., but is a smaller insect, of lighter colour, with elytra less closely punctulate, and having the frons more convex so as to appear more distinct from the clypeus, with the clypeal suture more conspicuous. I have seen about a dozen specimens of *sequens* and about half that number of *sollicitus*.

H. pellucidus, Burm. The characters assigned to this species appear scarcely reconcilable with its being a true *Heteronyx*, especially the front claws of the male "strongly unequal," and the front tibiæ with two strong external teeth near the apex and a very small tooth close to the knee. There are *Heteronyces* (especially in Group VIII.) having a sexual difference in the front claws, but I have not observed any

with the claws unequal in either sex; the description of the front tibiæ reads like that of an *Automolus* rather than a *Heteronyx*. If those difficulties be waived it seems probable that the hind claws are bifid as the front claws of the male are said to be, and in that case the species falls into Group VII. of *Heteronyx*, and is probably not far removed from *H. bidentatus*, Blackb. The locality assigned to *pellucidus* is South Australia, where, however, I have no evidence of the occurrence of any species near *bidentatus*, and certainly it would not be practicable to identify *H pellucidus* except by means of a specimen taken in Burmeister's locality. I conclude, therefore, that this species must remain an enigma until the type can be re-examined, or some insect agreeing with the description in respect of sexual characters can be found.

H. siccus, Blackb., and *H. Cowelli*, Blackb. These species were described as having bifid claws, and, therefore, might be looked for in this Group: their claws cannot, however, be considered bifid according to the more exact definition of terms that I have adopted for the purpose of the present Revision, and I therefore transfer them to Group VIII. *H. Cowelli* is, however, as noted under Group VIII, a synonym of *H. concolor*, Macl.

H. infuscatus, Macl. This species—the type of which I have examined in the Australian Museum—is very close to *H. rotundifrons*, Blackb. The distinction of labrum referred to in the tabulation is much like that between *H. granulatus* and *maurulus* of Group VI. (which is discussed under the heading of *H. maurulus*), and further differences are found in the notably smaller size of *H. infuscatus*, the considerably better-developed trilobed outline of the head in that species, its notably more convex frons, and its front tibiæ much more strongly and sharply dentate externally.

H. subfuscus, Macl. This species seems to be widely distributed in tropical Australia.

H. diversiceps, Blackb. This is the only *Heteronyx* known to me as occurring in Tasmania with bifid claws, and even of this species the claws cannot be called strongly bifid. As noted in the original description, this species is extremely difficult to place satisfactorily in any Group, and in my former Revision of this genus I assigned it to the "Intermediate" Group (now abolished), stating that the front of its head did not show a trilobed outline. That statement is not strictly correct, for (although from the ordinary point of view for examining the outline of the head that outline looks like an even curve) a threefold convexity is certainly visible if the head be viewed less obliquely—*i.e.*, from more directly above

it—a fact which I overlooked when I described the species. It would certainly be quite out of place in Group III., to which it would have to be referred if the front outline of its head were regarded as not trilobed.

H. potens, Blackb., and its allies. The species of this aggregate (of Group VII., having the antennal flabellum black) are incapable of confusion with any other *Heteronyces*, but are extremely closely allied, *inter se*, and variable—at any rate in respect of colour and size. I believe that I have before me at least six species of this aggregate, but three of them are represented by very few specimens, few of which are in satisfactory condition, and I do not feel justified in dealing with them. The species which I have called *potens* is usually named *aphodioides*, Blanch., but I think this a mistake, inasmuch as its general size is larger than that Blanchard attributes to his species: it is one of the most opaque of the *Heteronyces* (Blanchard calls his species "subnitidus"), and its dorsal puncturation is exceptionally lightly impressed (Blanchard calls the pronotum and elytra of his species "profunde punctata"). I have little doubt that the true *H. aphodioides* is a small *Heteronyx*, which I have seen only from Sydney and the immediate suburbs, and which answers very well indeed to Blanchard's description. The three species characterized in the tabulation above are certainly all valid, and can easily be recognized by the characters cited. Besides these, I have before me two black specimens from Galston closely allied to *incultus*, but of wider and more depressed form, with the prothorax larger and more transverse; three specimens from Windsor possibly identical with the two from Galston, but entirely of a bright ferruginous colour, though apparently not immature, with only the antennal flabellum black; and a single specimen (in bad condition) from the Tweed River, near *potens*, but likely to prove distinct when a series of specimens in good condition can be examined.

H. sollicitus, sp. nov. Minus elongatus, postice sat dilatatus; minus nitidus; ferrugineus vel obscure brunneus, antennis palpisque sat pallidis; supra pilis minus brevibus adpressis nonnullisque erectis vestitus; clypeo (hoc antice late emarginato) fronteque sat æqualiter subrugulose punctulatis, ut plana parum disparia visis; labro clypei planum superanti; capite antice (a tergo oblique viso) tripliciter convexo (parte mediana quam lateralium dimidium angustiori); antennis 9-articulatis; prothorace quam longiori ut 9 ad 6 latiori, antice sat angustato, supra sat crebre minus subtiliter punctulato (puncturis circiter 24 in segmenti longitudine), lateribus (superne visis) sat arcuatis, angulis anticis sat acutis sat productis

posticis (superne visis) rotundato-obtusis, basi sat fortiter bisinuata, margine basali sat æquali; elytris crebre subtilius subaspere punctulatis (trans elytron puncturis circiter 36); pygidio leviter vel obsolete punctulato; coxis posticis quam metasternum haud brevioribus, quam segmentum ventrale 2um multo longioribus; tarsorum posticorum articulo basali quam 2us sat breviori quam 3us sub longiori; unguiculis bifidis. Long., 4½-5 l.; lat., 2⅛-2⅝ l.

This species is easily recognizable by the characters cited in the tabulation. I have before me specimens from North Queensland, Port Darwin, and North-West Australia which present slight differences, *inter se*, suggesting the possibility that investigation of more numerous examples may indicate their being distinct closely-allied species. In the Queensland specimen (the type) only, the pronotum is distinctly canaliculate, while that from North-West Australia only has some traces of elytral striation. It would not, however, be wise to treat them as specifically different without further evidence. The trilobed outline of the head in this species is strongly developed and divided.

North Australia (Mr. Perkins and Mr. Griffith).

H. ignobilis, sp. nov. Modice elongatus, postice sat dilatatus; ferrugineus; supra pilis minus brevibus adpressis nonnullisque erectis vestitus; clypeo crebre subrugulose punctulato, antice late emarginato; labro clypei planum superanti; capite antice (a tergo oblique viso) tripliciter convexo (parte mediana quam lateralium dimidium paullo angustiori); fronte sat grosse minus crebre punctulata; hac clypeoque ut plana manifeste disparia visis; antennis 9-articulatis; prothorace quam longiori ut 8 ad 5 latiori, antice minus angustato, supra subtilius sat crebre punctulato (puncturis circiter 23 in segmenti longitudine), lateribus (superne visis) leviter arcuatis, angulis, anticis sat acutis sat productis posticis (superne visis) rotundato-obtusis, basi sat fortiter bisinuata, margine basali ad latera summa nonnihil magis elevato; elytris crebre sat subtiliter subaspere punctulatis (trans elytron puncturis circiter 40); pygidio obsolete sparsim punctulato; coxis posticis metasterno longitudine sat æqualibus, quam segmentum ventrale 2um multo longioribus; tarsorum posticorum articulo basali quam 2us parum breviori quam 2us parum longiori; unguiculis bifidis (minus fortiter). Long., 4 l.; lat., 2 l.

This species bears considerable resemblance to *H. sollicitus*, Blackb., but is easily separated from it by its very different hind claws, which are somewhat near the border line

between bifid and appendiculate structure, the hinder of their projections being a good deal smaller than the apical, though too distinctly in the form of a triangular tooth to allow of the claw being called appendiculate. Further differences are to be noticed in the smaller size of this species, its prothorax more transverse and less narrowed in front, and the very notably finer puncturation of its elytra. *H. ignobilis* also bears a general resemblance to *H. Macleayi*, Blackb., in Group VIII., which, however, has hind claws simply appendiculate, pronotum less closely punctured, basal joint of hind tarsi shorter, etc. In this species the trilobed outline of the head scarcely differs from that of *H. sollicitus*.

North Queensland (Mr. Perkins).

H. infirmus, sp. nov. Sat elongato-ovalis; sat nitidus; brunneo-testaceus; supra pilis brevibus suberectis sparsius vestitus; clypeo grosse rugulose punctulato, antice late vix emarginato, oculos in exteriorem partem haud superanti; labro clypei planum superanti; capite antice (a tergo oblique viso) tripliciter convexo (parte mediana quam laterales sublatiori); fronte sat crebre sat fortiter nec rugulose punctulata; hac clypeoque ut plana disparia visis; antennis 9-articulatis; prothorace quam longiori plus quam duplo latiori, antice vix angustato, supra subtilius sat crebre punctulato (puncturis circiter 20 in segmenti longitudine), lateribus (superne visis) modice rotundatis, angulis anticis rotundatis parum productis posticis (superne visis) rotundatis, basi haud sinuata, margine basali æquali; elytris nonnihil rugulosis, subtilius minus crebre punctulatis (trans elytron puncturis circiter 30); pygidio subtilius sat crebre punctulato; coxis posticis metasterno longitudine sat æqualibus, quam segmentum ventrale 2^{um} multo longioribus; tarsorum posticorum articulo basali quam 2^{us} parum breviori quam 3^{us} paullo longiori; unguiculus bifidis Long., 4 l.; lat., $1\frac{2}{5}$ l.

The general resemblance of this species and its immediate allies is to *subferrugineus*, Burm., and its allies, and *angustus*, Blackb., and its allies, from both which aggregates their conspicuously bifid claws separate them without difficulty. The front tibiæ of this insect bidentate externally (the 3rd—uppermost—tooth being represented by a scarcely discernible inequality of outline) is an unusual character. The trilobed outline of the head is feebly developed and not at all divided, the lobes overlapping strongly, the middle lobe (labrum) unusually large, slightly wider than a lateral lobe. The general appearance is frail and slender for a *Heteronyx*.

Western Australia; Geraldton (Mr. Lea).

H. viduus, sp. nov. Sat elongato-ovalis; sat nitidus; brunneo-testaceus, capite rufescenti; supra fere glaber; clypeo crebre grosse ruguloso, antice subtruncato; labro clypei planum superanti; capite antice (a tergo oblique viso) tripliciter convexo (parte mediana quam laterales vix angustiori); fronte subtilius minus crebre nec ruguloso punctulata; hac clypeoque ut plana valde disparia visis; sutura clypeali angulata; antennis 9-articulatis; prothorace quam longiori duplo latiori, antice parum angustato, supra subtiliter minus crebre punctulato (puncturis circiter 18 in segmenti longitudine), lateribus (superne visis) leviter rotundatis, angulis anticis sat acutis leviter productis posticis (superne visis) sat rotundatis, basi haud sinuata, margine basali æquali; elytris nullo modo rugulosis, sparsius subtilius punctulatis (trans elytron puncturis circiter 24); pygidio fere ut elytra punctulato, in media parte longitudinaliter lævi; coxis posticis metasterno longitudine sat æqualibus, quam segmentum ventrale 2um multo longioribus; tarsorum posticorum articulo basali quam 2us multo breviori, 3o sat æquali; unguiculis bifidis. Long., 3½ l.; lat., 1½ l.

Structurally near the preceding (*H. infirmus*), but very distinct from it by the sharp well-defined 3rd (uppermost) external tooth of its front tibiæ, by the much finer and non-rugulose puncturation of its frons, by its clypeus projecting outward on either side distinctly beyond the contour of the eyes, by its pronotum much less closely punctulate in the lateral parts, by its elytra non-rugulose and less closely punctured, by the basal joint of its hind tarsi much shorter in proportion to the second joint, etc. The trilobed outline of the head resembles that of *infirmus*, but with the middle lobe less prominent and scarcely so wide.

North Queensland; Cairns (Mr. Lea).

H. pauxillus, sp. nov. Modice elongatus, postice leviter dilatatus; sat nitidus; pallide brunneo-testaceus; supra fere glaber; clypeo crebre fortiter ruguloso, antice subtruncato, oculos in exteriorem partem haud superanti; labro clypei planum superanti; capite antice (a tergo oblique viso) tripliciter convexo (parte mediana lateralibus sat æquali); fronte subtiliter minus crebre nec rugulose punctulata; hac clypeoque ut plana sat disparia visis; sutura clypeali sat arcuata; antennis 9-articulatis; prothorace quam longiori duplo latiori, antice parum angustato, supra subtiliter crebrius punctulato (puncturis circiter 20 in segmenti longitudine), lateribus (superne visis) modice rotundatis, angulis anticis vix acutis parum pro-

ductis posticis (superne visis) rotundatis, basi haud sinuata, margine basali æquali; elytris vix rugulosis, subtilius minus crebre punctulatis (trans elytron puncturis circiter 24); pygidio sparsius subtilius punctulato; coxis posticis metasterno longitudine sat æqualibus, quam segmentum ventrale 2um multo longioribus; tarsorum posticorum articulo basali quam 2us paullo breviori, 3o sat æquali; unguiculis bifidis. Long., $2\frac{1}{2}$ l.; lat., $1\frac{1}{4}$ l.

A very small fragile species. The two specimens in my collection do not bear a label of locality, and their elytra being unfortunately opened apart, I am not sure that the measurement of width or the description of outline is quite exact. A (probably) third specimen is immature and too much broken for certain identification, but is labelled "Roebuck Bay." This species may be distinguished among its near allies by its very small size alone, but differs also in respect of the characters indicated in the tabulation and in other characters cited in the description. The uppermost of the three external teeth on the front tibiæ is very small, but sharp and perfectly formed. The trilobed outline of the head scarcely differs from that of *H. viduus*.

Australia.

H. neglectus, sp. nov. Minus elongatus, postice sat dilatatus; sat nitidus; ferrugineus; supra pilis brevibus sat erectis minus crebre vestitus; clypeo crebre sat grosse ruguloso, antice late leviter emarginato, oculos in exteriorem partem haud superanti; labro clypei planum superanti; capite antice (a tergo oblique viso) tripliciter convexo (parte mediana quam lateralium dimidium sat latiori); fronte sat crebre sat grosse vix rugulose punctulata; hac clypeoque ut plana parum disparia visis; antennis 9-articulatis; prothorace quam longiori ut 16 ad 9 latiori, antice parum angustato, supra fortius minus crebre punctulato (puncturis circiter 16 in segmenti longitudine), lateribus (superne visis) sat arcuatis, angulis anticis sat obtusis minus productis posticis superne visis fere rotundatis, basi vix sinuata, margine basali sat æquali; elytris haud rugulosis, sparsius minus fortiter punctulatis (trans elytron puncturis circiter 24); pygidio sparsim minus fortiter punctulato; coxis posticis quam metasternum vix brevioribus quam segmentum ventrale 2um multo longioribus; tarsorum posticorum articulo basali quam 2us paullo breviori, 3o sat æquali; unguiculis bifidis. Long., 4 l.; lat. $2\frac{1}{10}$ l.

I have hitherto confused this species with *H. incola*, Blackb., but am satisfied that it is distinct. It is a particu-

larly difficult species for a tabulation, because in two respects it is near the border land between aggregates. Its hind claws are not of the conspicuously bifid type, the hinder of their two projections being much smaller than the apical; the hinder projection, however, is decidedly more defined than that in any species whose claws I have called appendiculate, and is wide, with its apex truncate, the middle and front claws being, moreover, quite unmistakably of the bifid type. The prothorax of this species is very little less than twice as wide as long; by measurement it is *actually* less than twice, and when placed beside a species in which the prothorax is fully twice as wide as long it is quite apparent that the prothorax is less transverse. It will, however, be well to note that if the species were to be mistaken for one with the wider prothorax its place would be regarded as near *viduus* and *pauxillus*, to neither of which it bears much general resemblance, differing from the former, *inter alia*, by its coarsely-punctured frons nearly continuous in plane with the clypeus, and from the latter by its very much larger size, etc. It is easily separable from *incola* by the clypeal character indicated in the tabulation, and in addition the puncturation of its elytra is quite evidently finer, and the basal joint of its hind tarsi is quite evidently longer in proportion to the 2nd joint. The trilobed outline of its head is fairly well defined, but not quite divided, the middle lobe about two-thirds of a lateral lobe in size. The front of the pronotum bears a fringe of erect hairs, as in *incola*.

North Queensland.

H. modestus, sp. nov. Modice elongatus, postice leviter dilatatus; sat nitidus; ferrugineus; supra fere glaber, pilis perbrevibus perpaucis erectis vestitus (exemplo typico forsitan nonnihil abraso); clypeo crebre ruguloso, antice late leviter emarginato; labro clypei planum superanti; capite antice (a tergo oblique viso) tripliciter convexo (parte mediana quam laterales paullo angustiori); fronte subtiliter minus crebre nec rugulose punctulata; hac clypeoque ut plana sat disparia visis; antennis 9-articulatis; prothorace quam longiori ut 3 ad 2 latiori, antice leviter angustato, supra subtiliter minus crebre punctulato (puncturis circiter 18 in segmenti longitudine), lateribus (superne visis) sat arcuatis, angulis anticis vix acutis modice productis posticis (superne visis) sat rotundatis, basi vix sinuata, margine basali subtili æquali; elytris sat fortiter minus crebre punctulatis (trans elytron puncturis circiter 22); pygidio sparsius subtilius punctulato; coxis posticis quam metasternum vix brevioribus,

quam segmentum ventrale 2^{um} multo longioribus; tarsorum posticorum articulo basali quam 2^{us} multo, quam 3^{us} vix, breviori; unguiculis bifidis. Long., 3 l.; lat., 1½ l.

A distinct little species not likely to be confused with any other known to me. Its unusually narrow prothorax is noteworthy. Its trilobed outline is well defined but not divided, the middle lobe somewhat strongly prominent and about three-quarters of a lateral lobe in size.

North Queensland (Mr. Perkins).

H. rectangulus, sp. nov. Modice elongatus, postice paullo dilatatus; sat nitidus; ferrugineus; supra pilis minus brevibus sparsius vestitus; clypeo crebre subtilius ruguloso, antice late nonnihil emarginato; labro clypei planum superanti; capite antice (a tergo oblique viso) tripliciter convexo (parte mediana quam laterales sat angustiori); fronte fortius subrugulose punctulata; hac clypeoque ut plana valde disparia visis; antennis 9-articulatis; prothorace quam longiori ut 7 ad 4 latiori, antice leviter angustato, supra sparsius minus fortiter punctulato (puncturis circiter 16 in segmenti longitudine), lateribus (superne visis) minus arcuatis, angulis anticis sat acutis sat productis posticis (superne visis) acute rectis, basi sat fortiter bisinuata, margine basali sat æquali; elytris sat fortiter minus crebre punctulatis (trans elytron puncturis circiter 22); pygidio fortius crebrius punctulato; coxis posticis quam metasternum sat brevioribus quam segmentum ventrale 2^{um} sat longioribus; tarsorum posticorum articulo basali quam 2^{us} paullo breviori, quam 3^{us} sublongiori; unguiculis bifidis. Long., 4 l.; lat., 2 l

The sharply-defined hind angles of the prothorax of this species are unusual; viewed obliquely from in front the pronotum is seen to be somewhat expanded and reflexed at the hind angles, but the actual raised edging is not accentuated. The trilobed outline of the head is very strongly developed and divided, the middle lobe about two-thirds of a lateral lobe in size.

South Australia; Pinnaroo (Mr. Griffith).

H disjectus, sp. nov. Modice elongatus, postice leviter dilatatus; sat nitidus; ferrugineus; supra pilis brevibus erectis sparsim vestitus; clypeo crebre subtilius ruguloso, antice late leviter emarginato; labro clypei planum superanti; capite antice (a tergo oblique viso) tripliciter convexo (parte mediana quam laterales sat angustiori); fronte crebre subtilius nonnihil rugulose punctulata; hac

clypeoque ut plana parum disparia visis; antennis 9-articulatis; prothorace quam longiori ut 16 ad 9 latiori, antice sat angustato, supra crebrius subtilius punctulato (puncturis circiter 19 in segmenti longitudine), lateribus (superne visis) leviter arcuatis, margine laterali antice dilatato, angulis anticis sat acutis parum productis posticis (superne visis) obtusis, basi bisinuata, margine basali sat æquali; elytris crebrius sat fortiter punctulatis (trans elytron puncturis circiter 25); pygidio crebrius fortius punctulato; coxis posticis quam metasternum sat brevioribus, quam segmentum ventrale 2um sat longioribus; tarsorum posticorum articulo basali quam 2us sat breviori, quam 3us sublongiori; unguiculis bifidis. Long., 4 l.; lat., 2 l.

Resembles the preceding *(H. rectangulus)*, but with a very different prothorax, the hind angles viewed obliquely from the side being seen to be entirely rounded off, while in *rectangulus* they are from all points of view sharp right angles. Other differences will be noted by comparing the descriptions. The trilobed outline of the head is well defined, and is divided, but not so strongly as in *rectangulus*, the middle lobe a little more than two-thirds of a lateral lobe. Some specimens (apparently females) are a little broader and more ovate than the others. The type described above is a male.

Western Australia; Swan River (Mr. Lea).

H. lucidus, sp. nov. Modice elongatus, postice vix dilatatus; nitidus; piceo-ferrugineus, palpis antennisque dilutioribus; supra pilis minus brevibus erectis sparsim vestitus; clypeo crebre subtilius ruguloso, antice late sinuato; labro clypei planum vix superanti; capite antice (a tergo oblique viso) tripliciter convexo (parte mediana quam laterales sat angustiori); fronte rugulose sat fortiter punctulata; hac clypeoque ut plana vix disparia visis; antennis 9-articulatis; prothorace quam longiori ut 9 ad 5 latiori, antice sat angustato, supra sparsim minus fortiter punctulato (puncturis circiter 13 in segmenti longitudine), lateribus parum arcuatis, margine laterali antice dilatato, latitudine majori ad basin sita, angulis anticis obtusis vix prominulis posticis (superne visis) sat acute rectis, basi sat fortiter bisinuata, margine basali sat æquali; elytris fortiter minus crebre punctulatis (trans elytron puncturis circiter 20); pygidio minus nitido sparsim subtilius punctulato; coxis posticis quam metasternum multo brevioribus, quam segmentum ventrale 2um sat longioribus; tibiarum anticarum dentibus

externis obtusis; tarsorum posticorum articulo basali quam 2^{us} vix breviori, quam 3^{us} longiori; unguiculis bifidis. Long., $4\frac{1}{2}$ l.; lat., $2\frac{1}{4}$ l.

This species forms with *H. infuscatus*, Macl., *rotundifrons*, Blackb., and *fictus*, Blackb., an aggregate of closely-allied species. From both the former two it differs, *inter alia*, very conspicuously by the nearly straight sides of its prothorax, which is at its widest across the base. From *H. fictus*, which resembles it in the shape of the prothorax, it differs by the character mentioned in the tabulation and also by the much less coarse puncturation of its dorsal surface. The trilobed outline of the head, though distinct, is very feebly developed and not divided, the middle lobe a little more than half a lateral lobe in size. My specimens of this insect are from New South Wales, but I am not sure of their exact habitat: I believe they were sent to me from Mulwala by Mr. Sloane

New South Wales.

H fictus, sp. nov. Modice elongatus, postice vix dilatatus; sat nitidus; ferrugineus; supra pilis erectis sat brevibus sparsius vestitus; clypeo crebre subtilius ruguloso, antice late sinuato; labro clypei planum vix superanti; capite antice (a tergo oblique viso) tripliciter convexo (parte mediana quam laterales sat angustiori); fronte rugulose sat grosse punctulata; hac clypeoque ut plana minus disparia visis; antennis 9-articulatis; prothorace quam longiori ut 13 ad 8 latiori, antice sat angustato, supra sparsim sat grosse punctulato (puncturis circiter 12 in segmenti longitudine), lateribus parum arcuatis, margine laterali antice dilatato, latitudine majori ad basin sita, angulis anticis obtusis vix prominulis posticis (superne visis) rectis, basi sat fortiter bisinuata, margine basali sat æquali; elytris sat grosse minus crebre punctulatis (trans elytron puncturis circiter 18); pygidio minus nitido sparsim obsolete punctulato; coxis posticis quam metasternum multo brevioribus, quam segmentum ventrale 2^{um} sat longioribus; tibiarum anticarum dentibus externis acutis; tarsorum posticorum articulo basali quam 2^{us} vix breviori, quam 3^{us} longiori; unguiculis bifidis. Long., 4 l.; lat., 2 l.

Closely associated with *H. lucidus* in respect of its more important structural characters, but differing from that species in the form of its front tibiæ and in the much coarser puncturation of its dorsal surface. The three specimens before me are all of smaller size and lighter colour than any specimen

that I have seen of *lucidus*. The trilobed outline of the head is like that of *lucidus*, but the middle lobe is narrower—scarcely more than half a lateral lobe.

New South Wales; Sydney and Jenolan Caves (Mr. Lea).

H. pauper, sp. nov. Minus elongatus, postice leviter dilatatus; modice nitidus; ferrugineus; supra pilis brevibus adpressis minus crebre vestitus; clypeo (hoc antice leviter emarginato) fronteque crebre rugulosis, ut plana minus disparia visis; labro clypei planum leviter superanti; capite antice (a tergo oblique viso) tripliciter convexo (parte mediana quam laterales sat angustiori); antennis 9-articulatis; prothorace quam longiori ut 7 ad 4 latiori, antice minus fortiter angustato, supra crebrius minus fortiter punctulato (puncturis circiter 20 in segmenti longitudine), lateribus (superne visis) prope medium fortiter dilatato-rotundatis, margine laterali æquali, angulis anticis rectis leviter productis posticis (superne visis) rotundatis, basi vix bisinuata, margine basali æquali; elytris minute granulatis crebre subtilius leviter nec aspere punctulatis (trans elytron puncturis circiter 27); pygidio sparsim fortius punctulato; coxis posticis quam metasternum sat brevioribus quam segmentum ventrale 2um paullo longioribus; tarsorum posticorum articulo basali quam 2us manifeste breviori, quam 3us paullo longiori; unguiculis bifidis. Long., 3 l.; lat., $1\frac{3}{5}$ l.

This species is near *H. borealis* and *sordidus*. From the former it is very easily distinguishable by the very much more strongly rounded sides of its prothorax. It is much closer to *H. sordidus*, from which it differs, however, by its evidently wider form; its prothorax less narrowed in front, with sides even more strongly rounded, greatest width nearer the middle, hind angles quite rounded off, and puncturation evidently a little stronger and less close; its elytral punctures a little less close, less strongly impressed, and not asperate; its hind coxæ very evidently shorter, etc. It bears much resemblance to several species near the end of Group VIII., from which its claws (all of them bifid) readily distinguish it.

North Queensland (Mr. Perkins).

H sordidus, sp. nov. Modice elongatus, postice leviter dilatatus; minus nitidus; ferrugineus; supra pilis brevibus adpressis minus crebre vestitus; clypeo crebre ruguloso, antice leviter emarginato; labro clypei planum vix superanti; capite antice (a tergo oblique viso) tripliciter convexo (parte mediana quam laterales sat angustiori); fronte rugulose sat grosse punctulata; hac clypeoque ut plana sat disparia visis; antennis 9-articulatis, brevibus;

prothorace quam longiori ut 7 ad 4 latiori, antice fortiter angustato, supra crebrius sat subtiliter punctulato (puncturis circiter 22 in segmenti longitudine), lateribus (superne visis) fortiter arcuatis pone medium dilatato-rotundatis, margine laterali æquali, angulis anticis obtusis parum productis posticis (superne visis) rotundato-obtusis, basi leviter bisinuata, margine basali æquali; elytris crebre subtilius nonnihil aspere punctulatis (trans elytron puncturis circiter 30); pygidio longitudinaliter carinato, sparsim grossius punctulato; coxis posticis quam metasternum sat brevioribus, quam segmentum ventrale 2um sat longioribus; tarsorum posticorum articulo basali quam 2us manifeste breviori, quam 3us paullo longiori; unguiculis bifidis. Long., 3⅝ l.; lat., 1⅜ l.

Not very close to any other species known to me, except *H. pauper*, but to a casual glance of very ordinary appearance, with much general resemblance to those small obscure-looking species which I have placed in the latter part of Group. VIII. (*H. parvulus*, Macl., etc.)—a resemblance which is shared by *H. infuscatus*, Macl., and several others near it in the tabulation. The sculpture of its dorsal surface and most of its other characters are much like those of *H. borealis*, Blackb., but it is very distinct from that species by the shape of its prothorax (strongly narrowed in front and with the sides strongly rotundate-dilatate behind the middle) and by the notably wider and less prominent middle lobe of the trilobed outline of its head; its trilobed outline being very feeble and not divided, with the middle lobe about three-quarters of a lateral lobe in size.

North Queensland (Mr. Perkins).

H humilis, sp. nov. Modice elongatus, postice leviter dilatatus; sat nitidus; ferrugineus; supra pilis adpressis minus brevibus sparsius vestitus; clypeo sat grosse ruguloso, antice oblique elevato-truncato; labro clypei planum superanti; capite antice (a tergo oblique viso) tripliciter convexo (parte mediana quam lateralium dimidium angustiori); fronte vix rugulose sat grosse puctulata; hac clypeoque ut plana valde disparia visis; antennis 9-articulatis; prothorace quam longiori ut 7 ad 4 latiori, antice fortiter angustato, supra minus crebre sat fortiter punctulato (puncturis circiter 18 in segmenti longitudine), lateribus (superne visis) sat fortiter arcuatis, margine laterali æquali, angulis anticis acutis sat productis posticis (superne visis) rotundato-obtusis, basi modice bisinuata, margine basali æquali; elytris crebrius

minus fortiter punctulatis (trans elytron puncturis circiter 28); pygidio crebrius minus fortiter punctulato; coxis posticis quam metasternum multo brevioribus, quam segmentum ventrale 2um sat longioribus; tarsorum posticorum articulo basali quam 2us sat breviori, 3o sat æquali; unguiculis bifidis. Long., 3⅛ l.; lat., 1⅝ l.

The form of the clypeus is unusual, the middle appearing as if a small piece had been obliquely (from the dorsal surface downward and forward) sliced off, and the marginal edging following the outline of the truncature so formed. The front of the pronotum bears a fringe of long erect hairs; this is, I think, a character of some importance, but its value is discounted for practical purposes by the ease with which the hairs are rubbed off, so that it is difficult to be sure that their absence is not accidental unless one is sure that the specimen examined is not abraded. The trilobed outline of the head is strongly developed and strongly divided, the middle lobe a little less than half of a lateral lobe in size.

New South Wales; Young (Mr. Sloane).

H. cliens, sp nov. Modice elongatus, postice parum dilatatus; sat nitidus; ferrugineus; supra pilis adpressis minus brevibus sparsius vestitus; clypeo (hoc antice rotundatim sat late emarginato) fronteque crebre sat grosse rugulosis ut plana parum disparia visis; labro clypei planum superanti; capite antice (a tergo oblique viso) tripliciter convexo (parte mediana quam lateralium dimidium sat angustiori); antennis 9-articulatis; prothorace quam longiori ut 7 ad 4 latiori, antice parum angustato, supra minus crebre sat fortiter punctulato (puncturis circiter 18 in segmenti longitudine), lateribus (superne visis) leviter arcuatis, margine laterali æquali, angulis anticis obtusis minus productis posticis (superne visis) rotundato-obtusis, basi modice bisinuata, margine basali æquali; elytris crebrius minus fortiter punctulatis (trans elytron puncturis circiter 28); pygidio crebrius minus fortiter punctulato; coxis posticis quam metasternum sat brevioribus, quam segmentum ventrale 2um sat longioribus; tarsorum posticorum articulo basali quam 2us paullo breviori, 3o sat æquali; unguiculis bifidis. Long., 3⅝ l.; lat., 1⅞ l.

Easily distinguishable by the characters cited in the tabulation. Rather close to *H. humilis*, but differing by (in addition to the character cited in the tabulation) its prothorax much less narrowed in front (so that the segment looks more transverse, to a casual glance), its clypeus normally emarginate in front, its longer hind coxæ, etc. The trilobed out-

line of the head is not divided, the middle lobe not projecting nearly so far as the lateral lobes.

New South Wales; Queanbeyan (Mr. Lea).

Group VIII.

The division of the aggregate AA in this Group into two aggregates distinguished by the length of the hind coxæ is not quite so easy of application as the corresponding division in the other Groups, owing to the presence of a few species (mostly of abnormally elongate form), in which the hind coxæ do not quite fit any formula that is satisfactory in respect of the other species. Some remarks on these two aggregates (B and BB) of the aggregate AA, therefore, seem necessary. The normal condition of species of B is: hind coxæ as long (or all but as long) as the metasternum, at any rate very much nearer to the length of the metasternum than to that of the 2nd ventral segment, covering the 1st ventral segment (*i.e.*, that which is very narrowly visible between the hind trochanters as apparently the 1st ventral segment), or exposing only a very narrow strip of it (much narrower than half of the next segment). There are a few species which differ from the normal only in the exposure of an exceptionally wide strip of the 1st ventral segment, and these will present no difficulty, as they quite obviously belong to the aggregate with long hind coxæ. There is, however, one small aggregate which I have placed in B that undoubtedly seems to hover between B and BB. The species composing it are of more or less notably elongate form, the elongation being especially conspicuous in the ventral segments. The 1st ventral segment is widely exposed in them all, and in two of them (*longulus* and *lubricus*) the hind coxæ are very decidedly shorter than the metasternum, and, in fact, somewhat intermediate in length between the metasternum and the unusually elongate 2nd ventral segment—indeed, in *lubricus* they seem to be a trifle more nearly equal to the latter in length than to the metasternum. I think, however, that wherever they be placed they must be associated together, and as the three of them not already mentioned by name (*pallidulus*, Macl., *flavus*, Blackb., and *angustus*, Blackb.) have hind coxæ scarcely or very little shorter than the metasternum, and, therefore, would be much more out of place in BB than *longulus* and *lubricus* in B, it seems necessary to place them all in the aggregate B. They are easily recognizable species, having two characters which are unusual (especially in combination), *viz.*, the outline of the eye slightly passing, or, at any rate, fully reaching, that of the clypeus laterally; and the apex

of the lateral margin of the hind coxæ carinate and subspiniform. The last-mentioned character is not present in any species that I have placed in the aggregate BB. The normal condition of species of BB is: hind coxæ much shorter than metasternum, and not more nearly equal in respect of length to the metasternum than to the 2nd ventral segment (in many species very little longer than the 2nd ventral segment), the exposed part of the 1st ventral segment half (or even more than half) as long as the 2nd ventral segment. The only departure known to me in BB from the above described condition sufficiently marked to be worthy of mention is in a very small number of species (*e.g.*, *H. fumatus*, Er.) in which the hind coxæ are unduly longer than the 2nd ventral segment, but these insects have an unusually long metasternum (very considerably longer than the hind coxæ) and also have the 1st ventral segment largely exposed.

The aggregate B of AA, it will be observed, is divided into two sections (C and CC), distinguished by the elytra being either very closely punctulate or notably less closely punctulate—in the former section 20 punctures from the suture not passing the middle of the elytra. The only species that can be considered near the border line between these sections is *furvus*, Blackb. (of the aggregate CC), in which about 17 elytral punctures from the suture reach the middle.

The pronotum of many species of *Heteronyx* is fringed in front with long erect hairs, and I believe their presence or absence to be of value in distinguishing species, but as the hairs in question are very easily rubbed off, I have not considered it wise to make much use of the character. The pronotum and elytra are usually (probably always in fresh specimens) fringed laterally also, but I have not found that character to be of value for distinguishing species.

It will be noted that in this Group I have described the claws only of the hind tarsi. In all the species all the claws are appendiculate, I believe (except in a few species whose front claws are described), but the other characters ascribed to the hind claws are not in all cases exactly reproduced in the other claws.

In some species of this Group (and in some instances in other Groups) individual specimens have feeble indications of a longitudinal channel on the pronotum. Its distinctness is certainly variable within the limits of a species, and (in some species, at any rate) is dependent on the degree of maturity of the specimen. It does not seem to be a reliable character for diagnosis.

The number of names of previously-described species confidently attributable to this Group is 51. I add 27 new names in the following pages. There are also 10 previously-described species which cannot be confidently placed in any Group without inspection of types that are not in Australia, but which probably are members of this or the preceding Group. They will be found enumerated in the Supplement following. Three species (of the 51 mentioned above) are not placed in the tabulation (*vide infra*) as the types are in Sydney, and I have not been able to examine them. They are *Erichsoni*, Blackb., *marginatus*, Blackb., and *scutatus*, Macl. Five names (of the 51 mentioned above) are synonyms, and will be found enumerated in the Supplement. The remaining names are placed in the tabulation:—

A. Male elytra black at base; pronotum clothed with long hairs in both sexes; elytra striate.
  B. Punctures of pronotum very close (10 from front not reaching middle),
    C. Antennal flabellum dark.
      D. Elytral interstices not conspicuously and evenly convex.
        E. Prothorax at its widest scarcely behind middle; sides very strongly rounded ... ... fallax, *Blackb.*
        EE. Prothorax at its widest considerably behind middle; sides only moderately rounded.
          F. All the elytral interstices flat, striæ very faint, basal black of male elytra wide ... dimidiatus, *Er.*
          FF. Alternate elytral interstices convex, striæ strong, basal black of male elytra narrow ... ... jubatus, *Blackb.*
      DD. Elytral interstices strongly and evenly convex ... ... striatipennis, *Blanch.*
    CC. Antennal flabellum testaceous ... fraternus, *Blackb.*
  BB. Punctures of pronotum much less close (10 from front well passing middle); antennal flabellum bright ferruginous .. .. hirtuosus, *Blanch.*
AA. Species not combining the characters of A.
  [3] B. Hind coxæ not or but little shorter than metasternum (*vide supra* in general remarks).
    C. Elytral punctures very close (20 from suture not passing the middle).

[3] *H. longulus*, Blackb., and *lubricus*, Blackb., are on the border line of this aggregate.

D. Hind claws elongate; apical piece not or scarcely shorter than basal, compressed and continuing general curve.
E Species of large size (more than 5 l.).
F. Labrum (viewed from in front) having a widely-erect face.
G. Elytral punctures excessively fine (much finer than in *H. jubatus*).
H. Punctures of pronotum excessively fine, like those of the elytra.
I. Species not having a conspicuous pencil of bristles at apex of suture.
J Whole surface of elytra bearing sparse minute granules emitting long erect hairs .. pustulosus, *Blackb.*
JJ. Elytra not bearing (unless a few close to base) long erect hairs.
K. Middle lobe of trilobed outline much more than half a lateral lobe . .. ... agrestis, *Burm.*
KK Middle lobe of trilobed outline not more than half a lateral lobe .. ... scalptus, *Blackb.*
II. Elytra having a conspicuous pencil of bristles at apex of suture ... elongatus, *Blanch.*
HH. Punctures of pronotum much larger (as large as those on elytra of *H. jubatus*) ... ... major, *Blackb.*
GG. Elytral punctures much less fine (scarcely finer than in *H. jubatus*) ... rhinastus, *Blackb.*
FF. Labrum not showing an erect front face ... . xanthotrichus, *Blackb.*
EE. Species of much smaller size (less than 4 l.) ... . Waterhousei, *Blackb.*
DD. Hind claws smaller, apical piece much smaller than basal and usually much bent.
E. Punctures of pronotum very small and close (10 from front not nearly reaching middle).

F. Trilobed outline of head well defined, more or less divided.

G. Front outline of clypeus not concave; clypeal suture strongly cariniform — laminatus, *Blackb.*

GG. Not with characters (in combination) of G.

H. Basal joint of hind tarsi as long as 2nd joint: elytra not with long setæ ... . subferrugineus, *Burm.*

HH. Not with characters (in combination) of H.

I. Puncturation of head rugulose and more or less coarse (not less so than in *H. jubatus*).

J. Elytra (at any rate near apex) bearing long coarse bristles — macilentus, *Blackb.*

JJ. Elytra not bearing long bristles ... Helmsi, *Blackb.*

II. Puncturation of head close, very fine, and scarcely rugulose .. doctus, *Blackb.*

FF. Outline of head feebly trisinuate, not at all divided — peregrinus, *Blackb.*

EE. Punctures of pronotum less close (10 from front nearly reach middle), and much larger .. .. Macleayi, *Blackb.*

CC. Elytral punctures much less close (20 from suture considerably pass middle).

D Trilobed outline strongly divided, middle lobe half a lateral lobe, or less.

E. Elytral punctures decidedly sparse (12 from suture reach at least to middle).

F. Stipes of antennæ more elongate and slender, joint 3 quite conspicuously longer than joint 4.

G. Prothorax much narrowed in front.

H. Punctures of frons and pronotum similar in size.

I. Lateral gutter of pronotum in front part conspicuously dilated with its lateral edging more raised ... vagans, *Blackb.*

II. Lateral gutter of pronotum and its edging even or almost so ... conjunctus, *Blackb.*

HH. Punctures of pronotum notably smaller than of frons ... ... castaneus, *Macl.*

GG Prothorax only very slightly narrowed in front Olliffi, *Blackb.*

FF. Stipes of antennæ short and stout, joint 3 only slightly longer than 4.

G. Punctures of frons and pronotum similar in size.

H. Prothorax considerably narrowed in front ... Erichsoni, *Blackb*

HH. Prothorax only very slightly narrowed in front ... ... mimus, *Blackb.*

GG. Punctures of pronotum notably smaller than of frons ... ... farinensis, *Blackb.*

EE. Elytral punctures considerably more numerous (12 from suture not reaching middle)

F. Lateral outline of prothorax (viewed from the side) strongly sinuate ... ... Hackeri, *Blackb.*

FF. Lateral outline of prothorax (viewed from the side) straight ... . badius, *Macl.*

DD. Trilobed outline not as D.

E Size at least moderate (much more than long., 2 l.).

F. Elytra not having a conspicuous transverse sulcus in apical part.

G. Not iridescent.

H. Punctures of pronotum very fine and close (20 from front scarcely reach middle) ... ... mœstus, *Blackb.*

HH. Punctures of pronotum much less numerous.

I. Postero-external angle of metasternum subspiniform; clypeus not angulate in front of eye and not passing outline of eye.

J. Sutural apex strongly carinate and conspicuously prominent hindward ... longulus, *Blackb.*

JJ. Sutural apex not as J.

K. Basal piece of hind claws quite strongly compressed.

L. Elytral punctures more sparse and deeply impressed (about 12 from suture reach middle) angustus, *Blackb.*

LL. Elytral punctures conspicuously more close and faintly impressed ... ... flavus, *Blackb.*

KK. Hind claws long, basal piece not compressed .

L. Apical piece of hind claws as long as basal lubricus, *Blackb.*

LL. Apical piece of hind claws notably shorter pallidulus, *Macl.*

II. Not combining the characters of I.

J. Basal edging of pronotum strongly raised in its lateral parts; size large (about 6 l.) amœnus, *Blackb.*

JJ. Basal edging of pronotum not or scarcely more raised laterally.

K. Elytral punctures quite sparse (about 10 from suture reach middle).

L. Joint 3 of antennæ not longer than joint 4 .. .. siccus, *Blackb.*

LL. Joint 3 of antennæ considerably longer than joint 4 ... ambiguus, *Blackb.*

KK. Elytral punctures much more numerous.

L. Prothorax across apex of middle line not or scarcely narrower than across base.

M. Clypeus and frons form a continuous even and evenly sculptured surface planiceps, *Blackb.*

MM. Clypeus and frons very distinct and differently sculptured ... collaris, *Blackb.*

LL. Prothorax across apex of middle line much narrower than across base.

M. Punctures of elytra numerous (30 or thereabout across an elytron).

N. Joint 3 of antennæ short (much shorter than 2 and about equal 4).

O. Hind femora extremely wide; size larger (more than 4½ l.) ... furvus, *Blackb.*

OO. Hind femora normal; size smaller (less than 4 l.) ... approximans, *Blackb.*

NN. Joint 3 of antennæ longer (scarcely shorter than 2 and notably longer than 4) ... ... ordinarius, *Blackb.*

MM. Punctures of elytra much less numerous (about 22 across an elytron) ... ... rusticus, *Blackb.*

GG. Iridescent beneath (dorsal surface pruinose) ... ... iridiventris, *Blackb.*

FF. Elytra with a deep transverse sulcus immediately before apex ... ... posticalis, *Blackb.*

EE. Size very small (less than 2 l.) ... ... minutus, *Blackb.*

BB. Hind coxæ much shorter than the metasternum.

C. Punctures of pronotum very fine and close (15 from front not or scarcely reaching middle).

D. Trilobed outline divided; middle lobe not or scarcely more than half of a lateral lobe ... ... puncticollis, *Blackb.*

DD. Trilobed outline not divided; middle lobe much larger ... ... simius, *Blackb.*

CC. Punctures of pronotum much less numerous.

D. Basal piece of hind claws strongly compressed; its inner outline quite straight, and parallel with the opposite outline.

E. Elytral punctures not very close (about 15 from suture at least reach middle).

F. Clypeus passes outline of eye and is angular, in front of eye ... ... montanus, *Blackb.*

FF. Clypeus not passing outline of eye and not angular ... ... miser, *Blackb.*

EE. Elytral punctures notably closer (15 from suture not very nearly reaching middle) substriatus, *Macl.*

DD. Hind claws not as D.

E. Punctures of pronotum very much smaller and closer than of elytra.

F. Hind series of large punctures on hind femora well separated throughout from hind margin ... ... nudus, *Blackb.*

FF. Hind series of large punctures on hind femora fringes hind margin in apical part ... ... Rothei, *Blackb.*

EE. Punctures of pronotum very much smaller and less close than of elytra ... ... impar, *Blackb.*

EEE. Punctures of dorsal surface not as E or EE.

F. Lateral sulcus of pronotum close to apex conspicuously expanded, with its edging more raised.

G. Elytra not clothed with long erect hairs ... ... fumatus, *Er.*

GG. Elytra clothed with long erect hairs ... . hirsutus, *Blackb.*

FF. Lateral sulcus of pronotum not or scarcely perceptibly expanded in front.

G. Elytra glabrous or with only extremely short (usually extremely sparse) hairs.

H. Elytral punctures not very close (12 from suture reach or pass middle).

I. Pronotum but little convex, viewed from the side.

J. Hind angles of pronotum viewed from above well marked subglaber, *Macl.*

JJ. KK. Hind angles of pronotum viewed from above rounded off ... ... nigrinus, *Blackb.*

II. Pronotum strongly convex, viewed from the side ... ... convexicollis, *Blackb.*

HH. Elytral punctures much closer (12 from suture not nearly reaching middle) ... ... vacuus, *Blackb.*

GG. Pilosity of elytra normally long and close.

H. Basal edging of pronotum unusually thick and strongly raised ...	oscillator, *Blackb.*
HH. Basal edging of pronotum fine and not raised above the general surface.	
I. Raised lateral edging of elytra continuous to sutural apex (apex not fringed with bristles).	
J. Pygidium non-carinate	parvulus, *Macl.*
JJ. Pygidium longitudinally carinate ...	calidus, *Blackb.*
II. Raised lateral edging of elytra not nearly continuous to sutural apex.	
J. Raised lateral edging ends on extreme margin of elytra.	
K. Lateral margins of prothorax diverge hindward much beyond middle (as much as in *H. jubatus)*	inconspicuus, *Blackb.*
KK. Lateral margins of prothorax diverge hindward but little beyond middle.	
L. Elytra unicolorous.	
M. Claws subbifid	concolor, *Macl.*
MM. Claws normally appendiculate (and very small)	subcylindricus, *Blackb.*
LL. Suture dark	suturalis, *Blackb.*
JJ. Raised lateral edging ends on apical part of elytra at base of apical membrane.	
K. Elytral punctures fine and close (15 from suture scarcely reach middle)	puer, *Blackb*
KK. Elytral punctures less fine and close (12 from suture reach middle) ..	mildurensis, *Blackb.*

H. dimidiatus, Er , and its allies. The species forming the aggregate A in my tabulation of characters in this Group are very distinct from all other *Heteronyces* known to me, not only by the combination of characters indicated in the tabulation, but also by the presence of an unusually well-marked difference between the sexes in respect of the front claws, the basal piece of those claws bearing on the inner margin in the male a laminiform process of more or less quadrate form, which, however, is feebly represented in the female also (the basal piece in the female being of a conspicuously compressed form). The males, moreover (in all the species of which I know the sexes with certainty) differ from the females in the presence of dark colouring on the basal part of the elytra. In this aggregate must be placed a species represented by a female example in the Macleay Museum ticketed with one of Mr. W. S. Macleay's labels bearing the name "*Cotidia australis*, Gory," under which name there is a quasi-description in Boisduval's memoir in the "Voyage de l'Austrolabe." The name "*australis*," however, had been used previously by Guérin for a *Heteronyx* from Tasmania which could not be identified or even referred to one of my Groups without examination of the type, as there is no reference to the labrum in the description; but there is nothing in the brief description inconsistent with its being a member of this present aggregate. The size given by Guérin (long., 11 mm.), nevertheless, points to its probably belonging to some other aggregate (probably Group IV.), and the locality renders it improbable that in any case *Cotidia australis* is identical with it. *Heteronyx (Cotidia) australis*, Gory (apparently a MS. name adopted by Boisd.) must, therefore, be regarded as a *nom. præ-occ.* I described the same species (Proc. Linn. Soc., N.S.W., 1889, p 672) under the name *fallax*, which, consequently, must stand as its name. The species of this aggregate are for the most part easy of identification, *inter se*, as will be seen by a reference to the tabulation. There are two of them, however, about which I am in some difficulty (*H. dimidiatus*, Er., and *H. jubatus*, Blackb.), to the extent that I am not quite certain regarding their females, inasmuch as I have not seen a female likely to be *dimidiatus* from the original locality (Tasmania), nor one from any other locality identical with any locality from which I have the male of *dimidiatus*. I have before me, however, a female from the Jenolan Cave district, and another from Armidale, which I cannot separate from male *dimidiatus* by any character not likely to be sexual. The males of *dimidiatus*, Er., and of *jubatus*, Blackb., are quite easy to distinguish from each other, the former being of narrow elongate form—the prothorax especially narrow, its

width not more than a third of the whole length of the insect—and its elytra with striæ very faintly defined, interstices equal, *inter se*, and flat, and fully the basal third black. The male of *jubatus* is a much more robust and less elongate insect—its elytra with well-impressed striæ, interstices (especially the alternate ones) distinctly convex, and the base only very narrowly black. The female of *jubatus* scarcely differs from the male except in respect of sexual characters, which however, include the absence of black colouring on the elytra and variably lighter colouring in general of the pronotum and under-surface. The specimens referred to above as probably females of *dimidiatus* differ from the males of that species only as the females of *jubatus* differ from their males, although, however, they are of a little more robust form than I should expect in female *dimidiatus*. Both species are fairly common. I have seen *jubatus* from South Australia, Victoria, and New South Wales; *dimidiatus* from Tasmania, South Australia, Victoria, and (if the females mentioned above are rightly identified) New South Wales. The following I regard as varieties, but they may prove to represent distinct species: *(a) jubatus*, var. female, entirely ferruginous except frons and antennal flabella, convexity of alternate interstices feeble (from Murray Bridge); *(b) jubatus*, var. male, the parts usually black are pale fuscous, not much darker than the other parts, male character of claws feeble (from Sydney); *dimidiatus*, var. male and female (very likely to be found a distinct species when more specimens can be examined) striæ more strongly impressed in both sexes, male elytra with basal half black, form a little less elongate (from Gisborne, Victoria).

H. striatipennis, Blanch. Of this species I have seen only a single female, which differs from the male (the only sex previously described) as does the female of *jubatus* from its male.

H. hirtuosus, Blackb. Varies a good deal in colouring. I described four varieties. It may be noted that all the specimens with dark colouring on the elytra are males.

H. jubatus, Blackb. For notes on this species see above, under *H. dimidiatus*, Er. In describing it I expressed doubt of its distinctness from *H. striatipennis*, Blanch., which I had not then seen. It is, however, quite distinct, differing in its wider and less cylindric form as well as in the sculpture of its elytra.

H. fraternus, Blackb. This species is in the unfortunate position of the type having perished. It was described on a unique example in the collection of the late Mr. J. Anderson. During the long illness of that gentleman (by whose

death science lost a most assiduous student) his collection fell into decay, and the specimen of *H. fraternus* has disappeared. In my own collection there is a specimen from the same locality as the type (Port Lincoln) which I compared many years ago with the type and labelled "apparently *H. fraternus* abraded." It must be noted that there is a doubt whether this species was rightly associated in the same aggregate as *jubatus*, Blackb. (where I then placed it), as I had not then observed the peculiar sexual characteristics common to *jubatus* and its allies. If the type was a female (as my abraded specimen seems to be) it is probable that the discovery of the male would confirm the association of the species with *jubatus*, but if the type was a male the species would probably have to be removed from the aggregate A to AA, in which case it would stand beside *H. waterhousei*, Blackb., differing from it by, *inter alia*, the very much closer puncturation of its pronotum.

H. pubescens, Macl. For this *nom. præoce* (previously used by Erichson, Weigm. Arch., 1842, I., p. 164) I propose the name *Erichsoni*.

H. sydneyanus, Blackb. In the original description of this species (Proc. Linn. Soc., N.S.W., 1890, p. 559) it was referred to the aggregate that is now Group VIII., with a note on the middle lobe of the trilobed outline of its head not forming a convex curve. As the Groups are characterized in this present Revision that character removes the species from Group VIII. to Group IV., where it will be found placed in the second subgroup. I accidentally omitted mention of this matter under the heading of Group IV.

H. vagans, Blackb. When I described this species I referred to it some specimens from Queensland which, however, I am now satisfied represent a distinct species. *H. vagans* and its allies are among the most difficult of the Australian *Heteronyces*, there appearing to be at least five species so closely allied that they could not be satisfactorily treated without the comparison of quite fresh well-mounted specimens, whereas of two of them the specimens before me are by no means in good condition. *H. vagans* I have not seen from any locality north of the Sydney district (the type is from Albury). It differs from the others of the aggregate, especially by, in combination, its prothorax considerably narrowed in front and the 3rd joint of its antennæ conspicuously more elongate. From the Tweed River I have received a species (which I describe as *H. Olliffi*), differing from the others by its almost black colour and its remarkably quadriform prothorax (the width of which across the point where the middle line meets the front margin is not appreciably less than across

the base); its antennæ are like those of *H. vagans*. Specimens from Queensland (*H. Erichsoni*, Blackb. = *pubescens*, Macl.) are extremely close to *vagans*, but with the prothorax very evidently less narrowed in front and the 3rd joint of the antennæ very much shorter. A badly-mutilated example from North-West Australia is near those from Queensland, but with the middle lobe of the trilobed outline of the head remarkably minute, the prothorax evidently more transverse, and probably other distinctions in the numerous parts of the body that are wanting. Finally, a specimen taken by the Horn Expedition in Central Australia has the prothorax of *vagans*, but with dorsal sculpture notably less rugulose, and the 3rd antennal joint distinctly shorter. In the original description of *H. vagans* the middle lobe of the trilobed outline of the head was called "about a quarter" of a lateral lobe; this somewhat unduly minimized it, and "a third" would be more accurate.

H. badius, Macl. I have found it necessary to tabulate the distinctive character of this species as consisting in the punctures of its elytra being more numerous than in the other species of the aggregate CC in AA, B, but not sufficiently numerous to associate it with those of C in AA, B. The fact is, the aggregates C and CC (*badius* being disregarded) are so particularly satisfactory that it would be undesirable to give them up for the sake of one species. Moreover, *badius* does not really confuse the tabulation, for, although its elytra are punctured much more closely than those of the other species of CC, it is not at all likely to be supposed a member of C, inasmuch as 20 punctures from the suture reach quite clearly beyond the middle of an elytron, across the whole elytron there being just about 30 punctures. In general appearance it is distinctly suggestive of the species described below as *H. Macleayi*, from which, however, it differs by several characters besides the puncturation, especially by its prothorax being considerably narrower in front, with front angles notably less produced.

H. subglaber, Macl. The type of this species is from North-West Australia. There are before me specimens from various localities in Northern Australia (scarcely any of them in really good condition) which I do not feel justified in describing as distinct species, but among which I have little doubt there are in reality several species closely allied to *subglaber*. They all agree with *subglaber*, and differ from *H. nigrinus* and *convexicollis* in the well-defined hind angles of their prothorax, which from certain points of view might almost be called "sharply rectangular." In the description of *subglaber* mention is made of a fovea on each side of the pro-

notum near the hind angles. This appears to be merely the depression which is more or less distinctly traceable at no great distance from the hind angles in most (if not all) *Heteronyces*. It certainly varies in *distinctness* within the limits of a species, but I think there are slight differences in its exact *position* on the pronotum which are probably specific; I have not, however, been able to regard this character as available for distinguishing species, on account of the differences of position being slight and the difference in distinctness being so variable as it is. I have a specimen from North-West Australia (certainly *subglaber*) in which the impression is scarcely traceable.

H. Cowelli, Blackb. An examination of the type specimen of *H. concolor*, Macl., has satisfied me that it is identical with *H. Cowelli*, and consequently the latter name must be dropped. *H. concolor* is not identical with the species which I referred to in Proc. Linn. Soc., N.S W., 1889, p. 682, as probably that insect.

H. major, sp. nov. Modice elongatus, postice sat dilatatus; minus nitidus; obscure fuscus, antennis palpisque ferrugineis; supra pilis adpressis brevibus sat dense vestitus, pronoto antice pilis elongatis erectis fimbriato; clypeo crebre subtilius ruguloso, antice late leviter emarginato; labro clypei planum superanti, antice late perpendiculari; capite antice (a tergo oblique viso) tripliciter convexo (parte mediana quam laterales sat angustiori): fronte crebre aspere minus subtiliter punctulata; hac clypeoque ut plana sat disparia visis; antennis 9-articulatis; prothorace quam longiori ut 14 ad 9 latiori, antice sat fortiter angustato, supra crebre sat subtiliter nec leviter punctulato (puncturis circiter 40 in segmenti longitudine), lateribus (superne visis) sat arcuatis, angulis anticis sat acutis sat productis posticis (superne visis) rotundato-obtusis, basi sat fortiter bisinuata, margine basali sat æquali: elytris longitudinaliter vix obsolete costulatis, confertim subtiliter minus leviter punctulatis (trans elytron puncturis circiter 50); pygidio crebre subtilius nec leviter punctulato; coxis posticis quam metasternum haud brevioribus, quam segmentum ventrale 2^{um} multo longioribus; tarsorum posticorum articulo basali quam 2^{us} sat breviori, 3^{o} sat æquali; unguiculis posticis elongatis appendiculatis, parte basali quam apicalis vix longiori. Long., 8 l.; lat., 3⅘ l.

One of the large species of the genus, and bearing much general resemblance to all the other species of the aggregate C in AA, B. It is, however, quite easily distinguishable

from them all by the characters cited in the tabulation. The apex of its elytral suture might, perhaps, be thought capable of confusion with that part of *H. elongatus* as having a pencil of bristles, but in this species similar bristles are closely placed along the whole apex of the elytra, and in *elongatus* are confined to the apex of the suture. The sculpture of its dorsal surface is very widely different from the corresponding sculpture in *elongatus*. The trilobed outline of the head is well developed and is divided, the middle lobe scarcely two-thirds of a lateral lobe in size. The outline of the erect face of the labrum (viewed from in front) is that of a segment of a circle (the normal condition in species whose head shows a trilobed outline).

New South Wales; Picton (Mr. Griffith).

H. xanthotrichus, sp. nov. Minus elongatus, postice minus dilatatus; minus nitidus; obscure ferrugineus; supra pilis adpressis brevibus sat dense vestitus, pronoto antice pilis elongatis erectis flavis fimbriato; clypeo crebre subtilius ruguloso, antice late leviter, emarginato; labro clypei planum superanti, antice haud perpendiculari; capite antice (a tergo oblique viso) tripliciter convexo (parte mediana quam laterales sat angustiori); fronte crebre subtilius leviter punctulata; hac clypeoque ut plana minus disparia visis; antennis 9-articulatis; prothorace quam longiori ut 12 ad 7 latiori, antice modice angustato, supra confertim subtiliter sat leviter punctulato (puncturis circiter 40 in segmenti longitudine), lateribus (superne visis) leviter arcuatis, angulis anticis sat acutis sat productis posticis (superne visis) rotundato-obtusis, basi sat fortiter bisinuata, margine basali ad latera summa paullo magis elevato; elytris sat obsolete nonnihil costulatis, confertissime subtilissime leviter punctulatis (trans elytron puncturis circiter 60); pygidio crebre subtiliter punctulato; coxis posticis quam metasternum haud brevioribus, quam segmentum ventrale 2^{um} multo longioribus; tarsorum posticorum articulo basali quam 2^{us} sat breviori, 3^{o} sat æquali; unguiculis posticis elongatis appendiculatis, parte basali quam apicalis vix longiori. Long., 6 l.; lat., 3 l.

The form of the labrum (not turned up perpendicularly in its apical part, but having its whole direction forward and upward) distinguishes this species readily from the others of its aggregate (C in AA, B). The trilobed outline of the head is well developed and is divided, the middle lobe a little more than half of a lateral lobe in size. *H. xanthotrichus* is near-

est to *agrestis*, Burm., having very similar dorsal sculpture, but, *inter alia*, the trilobed outline of its head is better developed, with narrower middle lobe. It also is somewhat close to *scalptus*, Blackb., in respect of dorsal sculpture, but its elytra have not the fine transverse wrinkling so evident in *scalptus*. The elongate hairs and bristles of its surface (*e.g.*, those on the tibiæ and those fringing the elytra) seem to have a more definitely yellow tone of colour than in some species; but this is, of course, a character of little importance, and may not be so conspicuous in all specimens if the general colour is at all variable.

Victoria and South Australia.

.*H Waterhousei*, sp. nov. Minus elongatus, postice minus dilatatus; minus nitidus; ferrugineus; supra pilis adpressis brevibus sat dense vestitus, pronoto antice pilis erectis fimbriato; clypeo crebre subtilius ruguloso, antice subtruncato, oculos in exteriorem partem haud superanti; labro clypei planum superanti; capite antice (a tergo oblique viso) tripliciter convexo (parte mediana quam laterales paullo angustiori); fronte subtilius sat crebre punctulata; hac clypeoque fere planum continuum efficientibus; antennis 9-articulatis; prothorace quam longiori ut 7 ad 4 latiori, antice minus angustato, supra subtiliter sat crebre punctulato (puncturis circiter 26 in segmenti longitudine), lateribus (superne visis) sat arcuatis postice nonnihil dilatato-rotundatis, angulis anticis subrectis parum prominulis posticis (superne visis) rotundato-obtusis, basi leviter bisinuata, margine basali sat æquali; elytris subtiliter confertim punctulatis (trans elytron puncturis circiter 50); pygidio crebre subtiliter punctulato; coxis posticis quam metasternum vix brevioribus quam segmentum ventrale 2^{um} multo longioribus; tarsorum posticorum articulo basali quam 2^{us} sat breviori 3^{o} sat æquali; unguiculis posticis elongatis appendiculatis, parte basali quam apicalis parum longiori. Long., $3\frac{4}{5}$ l.; lat., $1\frac{4}{5}$ l.

An isolated species resembling in respect of its general characters those of the aggregate DD of AA, B, but having claws like those of the aggregate D. Its superficial resemblance to *H. laminatus*, Blackb., is very marked, but it differs (independently of the claw structure) from that species by numerous characters—*e.g.*, middle lobe of trilobed outline much narrower and less prominent, and the punctures of its pronotum less close and considerably finer and of its elytra very evidently finer. The third (uppermost) external tooth of its front tibiæ is scarcely defined. The trilobed outline of the

head is well defined, but scarcely divided, the middle lobe a little more than two-thirds of a lateral lobe in size. I have named this species after the late Mr. G. R. Waterhouse, who did valuable work on Australian *Melolonthidæ*.

Western Australia; Eyre's Sandy Patch.

H. macilentus, sp. nov. Modice elongatus, postice vix dilatatus; minus nitidus; obscure fuscus, corpore subtus antennis palpis pedibusque ferrugineis; supra pilis brevibus adpressis et nonnullis (præsertim in pronoto antice et in elytris postice) elongatis erectis vestitus; clypeo (hoc antice late perleviter emarginato) fronteque crebre sat fortiter rugulosis, fere planum continuum efficientibus; labro clypei planum superanti; capite antice (a tergo oblique viso) tripliciter convexo (parte mediana quam laterales parum angustiori); antennis 9-articulatis; prothorace quam longiori ut 13 ad 7 latiori, antice modice angustato, supra crebre subtiliter punctulato (puncturis circiter 32 in segmenti longitudine), lateribus (superne visis) leviter arcuatis, angulis anticis sat acutis modice productis posticis (superne visis) rotundo-obtusis, basi vix manifeste bisinuata, margine basali ad latera summa manifeste magis elevato; elytris longitudinaliter sat obsolete striatis, confertim subtilissime punctulatis (trans elytron puncturis circiter 50), in parte apicali summa prope suturam breviter longitudinaliter carinato; pygidio sat crebre minus fortiter punctulato; coxis posticis quam metasternum haud brevioribus, quam segmentum ventrale 2^{um} multo longioribus; tarsorum posticorum articulo basali quam 2^{us} vix breviori quam 3^{us} multo longiori; unguiculis posticis appendiculatis, parte basali quam apicalis multo longiori. Long., 3 l.; lat., $1\frac{3}{8}$ l.

I believe the unique type of this species to be more or less abraded; the elongate setæ of its dorsal surface may be, therefore, more numerous in a fresh specimen. The sex of the type is doubtful. If it is a female there is a possibility of its being a member of the aggregate A, but that seems improbable on account of its front claws not having the compressed form which is quite conspicuous even in the females of the species that I have placed in A. If it were in A it would stand beside *H. fraternus*, Blackb., from which it differs by, *inter alia*, the basal joint of the hind tarsi very much longer in proportion to both the 2nd and 3rd joints. The trilobed outline of the head is well developed and lightly divided, with the middle lobe scarcely smaller than a lateral lobe. The small carina near the apex of the suture is remarkable, and may be sexual.

South Australia; Yorke Peninsula.

H. Macleayi, sp. nov. Minus elongatus, postice parum dilatatus; minus nitidus; fuscus, corpore subtus antennis palpis pedibusque dilutioribus; supra pilis brevibus adpressis sat dense et nonnullis erectis sat brevibus vestitus; clypeo crebre sat fortiter ruguloso, antice late leviter emarginato; labro clypei planum superanti; capite antice (a tergo oblique viso) tripliciter convexo (parte mediana quam lateralium dimidium subangustiori); fronte sat crebre fortius sat rugulose punctulata; hac clypeoque ut plana sat disparia visis; antennis 9-articulatis; prothorace quam longiori ut 15 (vix) ad 8 latiori, antice modice angustato, supra sat crebre subfortiter punctulato (puncturis circiter 22 in segmenti longitudine), lateribus (superne visis) modice arcuatis, angulis anticis sat acutis modice productis posticis (superne visis) obtusis, basi sat fortiter bisinuata, margine basali ad latera vix magis elevato; elytris longitudinaliter obtuse vix manifeste costulatis, crebre subtiliter punctulato (trans elytron puncturis circiter 43); pygidio subtilius crebrius (maris minus crebre) punctulato; coxis posticis quam metasternum haud brevioribus, quam segmentum ventrale 2^{um} multo longioribus; tarsorum posticorum articulo basali quam 2^{us} sat breviori 3^{o} sat æquali; unguiculis posticis appendiculatis, parte basali quam apicalis multo longiori. Long., $4\frac{1}{2}$-5 l.; lat., $2\frac{1}{4}$-$2\frac{1}{2}$ l.

I formerly supposed this species to be *castaneus*, Macl. (and may have reported it to correspondents as probably that insect), there being no character in Macleay's brief description inconsistent with that determination, but an examination of the type has proved the contrary. The species is very easily identified (among all known to me) by the characters cited in the tabulation. The trilobed outline of the head is very well developed and is strongly divided, the middle lobe scarcely half of a lateral lobe in size. The punctures of the pronotum are very considerably larger than of the elytra.

North Queensland; Cairns, etc.

H. Olliffi, sp. nov. Modice elongatus, postice minus dilatatus; sat nitidus; nigro-piceus, antennis palpis pedibusque ferrugineis, corpore subtus plus minusve rufescenti; supra pilis brevibus suberectis sat dense vestitus; clypeo (hoc antice perleviter emarginato) fronteque crebre rugulose sat grosse punctulatis, ut plana sat disparia visis; labro clypei planum superanti; capite antice (a tergo oblique viso) tripliciter convexo (parte mediana quam laterales fere quadruplo angustiori); antennis 9-articulatis, articulo 3^{o} quam 2^{us} parum breviori quam 4^{us} multo longiori; prothorace quam longiori ut 9 ad 5

latiori, antice perparum angustato, supra fortiter sat crebre punctulato (puncturis circiter 20 in segmenti longitudine), sulco laterali antice fortiter dilatato, lateribus (superne visis) fere ad apicem sat rectis, angulis anticis acutis fortiter productis posticis (superne visis) rectis, basi sat fortiter bisinuata, margine basali ad latera summa magis elevato; elytris fortiter sat crebre punctulatis (trans elytron puncturis circiter 25); pygidio sparsim sat fortiter punctulato; coxis posticis quam metasternum paullo brevioribus quam segmentum ventrale 2um multo longioribus; tarsorum posticorum articulo basali quam 2us paullo breviori, 3o sat æquali; unguiculis posticis appendiculatis, parte basali quam apicalis multo longiori. Long., $4\frac{2}{5}$ l.; lat., $2\frac{1}{5}$ l.

A very easily recognizable species, especially in respect of the characters mentioned above under the heading of *H. vagans*, Blackb. The trilobed outline of the head is strongly divided, the middle lobe very little more than a quarter of a lateral lobe in size.

New South Wales; Tweed River (given to me by the late Mr. Olliff).

H. Erichsoni, sp. nov. New name for *H. pubescens*, Macl. *nom præocc*).

H conjunctus, sp. nov. Modice elongatus, postice minus dilatatus; modice nitidus; ferrugineus; supra pilis brevibus suberectis et nonnullis erectis sat elongatis vestitus; clypeo sat grosse sat rugulose punctulato, antice late leviter emarginato; labro clypei planum superanti; capite antice (a tergo oblique viso) tripliciter convexo (parte mediana lateralium dimidio sat æquali); fronte sat grosse vix rugulose punctulata; hac clypeoque ut plana sat disparia visis; antennis 9-articulatis, articulo 3o quam 4us multo longiori; prothorace quam longiori ut 9 ad 5 latiori, antice modice angustato, supra sparsius sat fortiter punctulato (puncturis circiter 16 in segmenti longitudine), lateribus (superne visis) minus arcuatis, sulco laterali sat æquali, angulis anticis acutis sat productis posticis (superne visis) rotundato-rectis, basi fortiter bisinuata, margine basali sat æquali; elytris sat fortiter sat crebre punctulatis (trans elytron puncturis circiter 25); pygidio sparsius leviter punctulato; coxis posticis quam metasternum parum brevioribus, quam segmentum ventrale 2um multo longioribus; tarsorum posticorum articulo basali quam 2us sat breviori quam 3us sublongiori; unguiculis posticis appendiculatis, parte basali quam apicalis multo longiori. Long., 4 l.; lat., 2 l.

Besides the distinctive characters indicated in the tabulation it may be noted that this species differs from most of the nearly allied species (as will be seen by comparing the descriptions) by the decidedly less numerous punctures of its pronotum. The trilobed outline of the head is well developed and is divided (but not strongly), its middle lobe just about half a lateral lobe in size

North Queensland (Mr. Perkins).

H. farinensis, sp. nov. Modice elongatus, postice parum dilatatus; minus nitidus; ferrugineus; supra pilis brevibus suberectis et nonnullis erectis magis elongatis vestitus, pronoto antice pilis sat longis fimbriato; clypeo (hoc antice leviter emarginato) fronteque crebre fortiter rugulosis, ut plana sat disparia visis; labro clypei planum superanti; capite antice (a tergo oblique viso) tripliciter convexo (parte mediana quam laterales multo angustiori); antennis 9-articulatis, articulo 3° quam 4^{us} vix longiori; prothorace quam longiori ut 9 ad 5 latiori, antice sat angustato, supra crebrius minus fortiter punctulato (puncturis circiter 21 in segmenti longitudine), lateribus (superne visis) sat arcuatis, sulco laterali sat æquali, angulis anticis sat acutis minus productis posticis (superne visis) obtusis, basi sat fortiter bisinuata, margine basali sat æquali; elytris sat fortiter sat crebre punctulatis (trans elytron puncturis circiter 27); pygidio leviter minus crebre punctulato; coxis posticis quam metasternum paullo brevioribus quam segmentum ventrale 2^{um} multo longioribus; tarsorum posticorum articulo basali quam 2^{us} sat breviori, 3° sat æquali; unguiculis posticis appendiculatis, parte basali quam apicalis multo longiori. Long., $4\frac{1}{2}$ l.; lat., $2\frac{1}{4}$ l.

It is noticeable that in this species the punctures of both the head and the elytra are quite conspicuously larger than those of the pronotum. The general resemblance to *H. vagans* is considerable, but even apart from the dorsal sculpture the much longer 3rd antennal joint of *vagans* furnishes a satisfactory distinction. The trilobed outline is well developed and divided, the middle lobe very narrow (scarcely a third of a lateral lobe in size).

Central Australia; Farina, etc.

H. Hackeri, sp. nov. Elongatus, postice modice dilatatus; minus nitidus; ferrugineus; supra pilis brevibus suberectis et nonnullis erectis magis elongatis vestitus (his præsertim in pronoto); clypeo crebre ruguloso, antice late leviter emarginato; labro clypei planum superanti; capite antice (a tergo oblique viso) tripliciter convexo (parte

mediana quam laterales multo angustiori); fronte rugulose sat grosse punctulata, hac clypeoque ut plana minus disparia visis; antennis 9-articulatis, articulo 3^{o} quam 4^{us} sat multo longiori: prothorace quam longiori ut 9 ad 5 latiori, antice sat angustato, supra fortius minus crebre punctulato (puncturis circiter 20 in segmenti longitudine), lateribus (superne visis) sat arcuatis (a latere visis) sat fortiter sinuatis, sulco laterali antice sat dilatato, angulis anticis acutis sat productis posticis (superne visis) rotundatim obtusis, basi sat fortiter bisinuata, margine basali sat æquali; elytris squamose subtiliter sat crebre punctulatis (trans elytron puncturis circiter 35); pygidio subtiliter vix crebre punctulato; coxis posticis quam metasternum haud brevioribus quam segmentum ventrale 2^{um} multo longioribus; tarsorum posticorum articulo basali quam 2^{us} sat breviori, quam 3^{us} sublongiori; unguiculis posticis appendiculatis, parte basali quam apicalis sat longiori ad apicem breviter spiniformi. Long., $5\frac{3}{5}$ l.; lat., $2\frac{1}{2}$ l.

This species is near *H. badius*, Macl., but is much larger, and the punctures of its pronotum and elytra are notably larger. The trilobed outline of the head is very distinctly but not very strongly divided, the middle lobe a little less than a lateral lobe in size.

North Queensland; Coen (Hacker). Given to me by Mr. Carter.

H. mœstus, sp. nov. Sat elongatus, postice sat dilatatus; minus nitidus; piceo-brunneus, antennis ferrugineis; supra pilis brevibus adpressis sat crebris et pilis nonnullis erectis elongatis vestitus; clypeo (hoc antice sat emarginato) fronteque sat crebre sat rugulose nec grosse punctulatis, ut plana modice disparia visis; labro clypei planum superanti; capite antice (a tergo oblique viso) tripliciter convexo (parte mediana quam lateralium dimidium manifeste latiori); antennis 9-articulatis robustis, articulo 3^{o} quam 2^{us} parum longiori; prothorace quam longiori ut 13 ad 8 latiori, antice fortiter angustato, supra confertim subtiliter subaspere punctulato (puncturis circiter 40 in segmenti longitudine), lateribus (superne visis) modice arcuatis, angulis anticis acutis modice productis posticis (superne visis) obtusis, basi sat fortiter bisinuata, margine basali ad latera paullo magis elevato; elytris vix manifeste striatis, subtilius sat crebre punctulatis (trans elytron puncturis circiter 40); pygidio subtiliter crebrius punctulato; coxis posticis quam metasternum vix brevioribus quam segmentum ventrale 2^{um} multo longioribus;

tarsorum posticorum articulo basali quam 2us parum breviori quam 3us sat longiori; unguiculis posticis robustis appendiculatis, parte basali quam apicalis parum longiori. Long., 6½ l.; lat., 3 l.

Easily recognizable by the characters cited in the tabulation. The trilobed outline of the head well defined but scarcely divided, the middle lobe about three-fifths of a lateral lobe in size.

New South Wales; Sydney (Mr. Lea).

H. amœnus, sp. nov. Sat elongatus, postice parum dilatatus; sat nitidus; læte ferrugineus; supra pilis sat brevibus suberectis, et in pronoto antice capiteque nonnullis elongatis erectis, vestitus; clypeo crebre sat grosse ruguloso, antice late leviter emarginato; labro clypei planum superanti; capite antice (a tergo oblique viso) tripliciter convexo (parte mediana quam laterales multo angustiori); fronte minus crebre sat grosse vix rugulose punctulato; hac clypeoque ut plana sat disparia visis; antennis 9-articulatis, articulo 3o parvo; prothorace quam longiori ut 11 ad 6 latiori, antice perparum angustato; supra fortiter minus crebre punctulato (puncturis circiter 18 in segmenti longitudine), lateribus (superne visis) leviter arcuatis, sulco laterali antice sat fortiter dilatato, angulis anticis acutis sat fortiter productis posticis (superne visis) sat rectis, basi bisinuata, margine basali ad latera multo magis elevato; elytris fortiter minus crebre punctulatis (trans elytron puncturis circiter 24); pygidio fortiter minus crebre punctulato; coxis posticis quam metasternum haud brevioribus, quam segmentum ventrale 2um multo longioribus; tarsorum posticorum articulo basali quam 2us sat breviori; unguiculis posticis elongatis appendiculatis. Long., 6 l.; lat., 2⅘ l.

A fine large species, of a bright-reddish ferruginous colour; readily distinguishable by the characters indicated in the tabulation. The trilobed outline of the head is fairly well developed but not divided, the middle lobe about two-fifths of a lateral lobe in size.

Western Australia; Mount Barker (Mr. Lea).

H. ambiguus, sp. nov. Minus elongatus, postice minus dilatatus; sat nitidus; fuscus, palpis antennisque ferrugineis; supra pilis brevibus suberectis nonnullisque sat elongatis erectis vestitus; clypeo (hoc antice late vix emarginato) fronteque (hac antice subito declivi) crebre sat grosse rugulosis, ut plana valde disparia visis; labro clypei planum superanti; capite antice (a tergo oblique viso) tripliciter convexo (parte mediana quam laterales

paullo angustiori); antennis 9-articulatis, articulo 3o quam 4us sat longiori; prothorace quam longiori ut 11 ad 6 latiori, antice modice angustato, supra fortiter minus crebre punctulato (puncturis circiter 14 in segmenti longitudine), lateribus (superne visis) rotundatis, sulco laterali antice sat dilatato, angulis anticis acutis sat productis posticis (superne visis) rotundatis, basi vix perspicue bisinuata, margine basali æquali; elytris granulatis, sparsius sat fortiter punctulatis (trans elytron puncturis circiter 20); pygidio sat fortiter minus crebre punctulato; coxis posticis quam metasternum parum brevioribus quam segmentum ventrale 2um multo longioribus; tarsorum posticorum articulo basali quam 2us paullo breviori quam 3us paullo longiori; unguiculis posticis sat elongatis, parte basali quam apicalis paullo longiori. Long., 4 l.; lat., 2 l.

Very distinct from all other species known to me except *H. siccus*, Blackb., which it resembles rather closely. Joint 3 of its antennæ much more elongate readily distinguishes it, however, from *siccus*, as also its puncturation notably coarser, prothorax with sides and hind angles more rounded, longer basal joint of hind tarsi, etc. The hind coxæ leave more than usual of the 1st ventral segment exposed, but are very little shorter than the metasternum. The trilobed outline of the head is feebly developed and not divided, the middle lobe about three-quarters of a lateral lobe in size. The pronotum is fringed with erect hairs in front.

Western Australia; Coolgardie.

H. planiceps, sp. nov. Elongatus, postice sat dilatatus; sat nitidus; ferrugineus, supra pilis brevibus adpressis et nonnullis in pronoto antice longioribus erectis vestitus; clypeo (hoc antice subtruncato) fronteque confertim nec grosse rugulosis, planum continuum efficientibus; labro clypei planum superanti; capite antice (a tergo oblique viso) tripliciter convexo (parte mediana lateralibus sat æquali); antennis 9-articulatis, articulo 3o quam 4us multo longiori; prothorace quam longiori ut 9 ad 5 latiori, antice parum angustato, supra subtiliter crebrius punctulato (puncturis circiter 25 in segmenti longitudine), lateribus (superne visis) sat arcuatis, sulco laterali antice leviter dilatato, angulis anticis acutis minus productis posticis (superne visis) rotundato-obtusis, basi vix perspicue sinuata, margine basali sat æquali; elytris subtilius sat crebre punctulatis (trans elytron puncturis circiter 30); pygidio subtilius sat crebre punctulato; coxis posticis quam metasternum vix brevioribus, quam

segmentum ventrale 2um multo longioribus; tarsorum posticorum articulo basali quam 2us multo, quam 3us vix, breviori; unguiculis posticis appendiculatis, sat elongatis, parte basali quam apicalis haud multo longiori. Long , 5 l.; lat., 2¼ l.

A remarkably narrow elongate species, the prothorax unusually small in comparison with the elytra. Not much like any other species known to me, though structurally near *collaris*, Blackb., which, however, is very much smaller and less elongate, with an unusually large prothorax, joint 3 of antennæ very short, basal joint of the hind tarsi as long as the 2nd joint, etc. The prothorax of *planiceps*, measured at the middle of the front margin, is very little narrower than at the base, the sides converging somewhat in front of the extremities of this line. The trilobed outline of the head is fairly well developed, but scarcely divided, the middle lobe about equal in size to a lateral lobe.

Western Australia; Geraldton (Mr. Lea).

H. approximans, sp. nov. Sat elongatus, postice leviter dilatatus; minus nitidus; ferrugineus; supra pilis adpressis sat brevibus et nonnullis elongatis erectis (his præsertim in pronoto antice et in capite sitis) vestitus; clypeo crebre ruguloso antice late vix emarginato; labro clypei planum superanti; capite antice (a tergo oblique viso) tripliciter convexo (parte mediana quam laterales sat angustiori); fronte fortiter sat crebre haud rugulose punctulata, hac clypeoque ut plana parum disparia visis; antennis 9-articulatis, articulo 3° quam 2us multo breviori quam 4us parum longiori; prothorace quam longiori ut 7 ad 4 latiori, antice sat angustato, supra subtilius sat crebre punctulato (puncturis circiter 25 in segmenti longitudine), lateribus (superne visis) sat arcuatis, sulco laterali antice haud dilatato nec margine laterali antice magis elevato, angulis anticis minus acutis minus productis posticis (superne visis) rotundato-obtusis, basi vix bisinuata, margine basali sat æquali; elytris crebre sat subtiliter subaspere punctulatis (trans elytron puncturis circiter 30); pygidio sparsius leviter punctulato; coxis posticis quam metasternum vix brevioribus, quam segmentum ventrale 2um multo longioribus; tarsorum posticorum articulo basali 2° sat æquali, quam 3us sat longiori; unguiculis posticis appendiculatis, parte basali quam apicalis sat longiori. Long., 3⅘ l.; lat., 1⅘ l.

This species is not at all close to any other known to me except the following species (*H. ordinarius*), from which, however, it is quite easily distinguishable by, *inter alia*, the

much shorter 3rd joint of its antennæ, its prothorax a little more transverse and having sides more rounded and lateral margins very different and hind angles rounded off, and its elytral puncturation distinctly asperate. The trilobed outline of the head is feebly developed and scarcely divided, the middle lobe about two-thirds of a lateral lobe in size.

New South Wales; Sydney (Mr. Lea).

H. ordinarius, sp. nov. Modice elongatus, postice sat dilatatus; sat nitidus; ferrugineus; supra pilis adpressis sat brevibus et nonnullis elongatis erectis (his præsertim in pronoto antice et in capite sitis) vestitus; clypeo crebre ruguloso, antice late leviter emarginato; labro clypei planum superanti; capite antice (a tergo oblique viso) tripliciter convexo (parte mediana quam laterales paullo angustiori); fronte sat fortiter sat crebre vix rugulose punctulata, hac clypeoque ut plana parum disparia visis; antennis 9-articulatis, articulo 3º quam 2us parum breviori quam 4us sat multo longiori; prothorace quam longiori ut 12 ad 7 latiori, antice sat angustato, supra subtilius sat crebre punctulato (puncturis circiter 25 in segmenti longitudine), lateribus (superne visis) minus arcuatis, sulco laterali antice sat dilatato, margine laterali antice sat multo magis elevato, angulis anticis sat acutis sat productis posticis (superne visis) sat rectis, basi leviter bisinuata, margine basali sat æquali; elytris crebre sat subtiliter punctulatis (trans elytron puncturis circiter 30); pygidio crebrius subtilius punctulato; coxis posticis quam metasternum parum brevioribus, quam segmentum ventrale 2um multo longioribus; tarsorum posticorum articulo basali 2º sat æquali, quam 3us sat longiori; unguiculis posticis appendiculatis, parte basali quam apicalis paullo longiori. Long., $3\frac{3}{5}$ l.; lat., $1\frac{4}{5}$ l.

For remarks on this species, see the preceding (*H. approximans*). The trilobed outline of the head is like that of *H. approximans*. I have before me a mutilated example of a species from Victoria which seems to be closely allied to this, but unfortunately it has lost its hind claws, and so cannot justifiably be described.

New South Wales; Thornleigh (Mr. Froggat).

H. minutus, sp. nov. Minus elongatus, postice vix dilatatus; minus nitidus; rufo-fuscus, antennis palpis pedibus corporeque subtus dilutioribus; supra nonnihil pruinosus, pilis perbrevibus sparsis adpressis et nonnullis elongatis erectis (his præsertim in pronoto antice et in capite sitis) vestitus; clypeo crebre subtilius ruguloso, antice subtruncato; labro clypei planum superanti; capite antice

(a tergo oblique viso) tripliciter convexo (parte mediana quam laterales sublatiori); fronte subtilius minus crebre nec rugulose punctulata, hac clypeoque ut plana sat disparia visis; antennis 9-articulatis, articulis 3-6 perbrevibus sat æqualibus; prothorace quam longiori ut 12 ad 7 latiori, antice sat angustato, supra subtilius leviter nec crebre punctulato (puncturis circiter 15 in segmenti longitudine) lateribus (superne visis) fortiter rotundatis, angulis anticis vix acutis modice productis posticis (superne visis) rotundatis, basi vix perspicue sinuata, margine basali subtili sat æquali; elytris perspicue striatis, sparsim leviter nec æqualiter punctulatis; pygidio longitudinaliter carinato, leviter sparsim punctulato; coxis posticis quam metasternum vix brevioribus, quam segmentum ventrale 2um multo longioribus; tarsorum posticorum articulo basali quam 2us nonnihil, quam 3us sat multo, longiori; unguiculis posticis appendiculatis, parte basali quam apicalis sat longiori. Long., $1\frac{3}{8}$ l.; lat., $\frac{3}{5}$ l.

Easily recognizable on account of its extremely small size. If size were disregarded and also the pruinosity of the elytra (involving, perhaps, a little iridescence), the species would have to be placed in the tabulation beside *H. siccus*, from which it differs by, *inter alia multa*, its elytra very distinctly striate. The puncturation of the elytra is sparse and not symmetrically distributed, so that the counting of punctures is of little use, but the number may be roughly stated as averaging about 15 across an elytron. The trilobed outline of the head is not strongly developed and is not divided, the middle lobe slightly larger than a lateral lobe.

South Australia; Sedan (taken by the late Mr. Rothe).

H. miser, sp. nov. Modice elongatus, postice leviter dilatatus; minus nitidus; ferrugineus; supra pilis brevibus adpressis vestitus; clypeo crebre sat fortiter ruguloso, antice truncato, oculos in exteriorem partem haud superanti; labro clypei planum superanti; capite antice (a tergo oblique viso) tripliciter convexo (parte mediana quam laterales parum angustiori); fronte sat fortiter minus crebre nec rugulose punctulata; hac clypeoque fere planum continuum efficientibus; antennis 9-articulatis, articulo 3o quam 1us parum longiori; prothorace quam longiori ut 3 ad 2 latiori, antice parum angustato, supra leviter canaliculato, subtilius vix crebre punctulato (puncturis circiter 20 in segmenti longitudine), lateribus (superne visis) parum arcuatis, angulis anticis sat acutis sat productis posticis (superne visis) sat acute rectis, basi sat fortiter bisinuata, margine basali ad latera vix

magis elevato; elytris subtilius squamose sat crebre punctulatis (trans elytron puncturis circiter 30); pygidio sparsius minus subtiliter punctulato; coxis posticis quam metasternum sat multo brevioribus, quam segmentum ventrale 2um sat longioribus; tarsorum posticorum articulo basali quam 2us vix breviori, quam 3us sublongiori; unguiculis posticis appendiculatis, partis basalis compressæ marginibus inter se parallolis. Long., 4 l.; lat., 2 l. (vix).

Besides the character noted in the tabulation as distinguishing this species from *H. montanus*, its clypeus is not emarginate in front (in *montanus* feebly so), its elytral punctures are smaller and more numerous and of the squamose form (in *montanus* about 25 across an elytron, and not squamose), and the basal piece of its claws is less widely compressed. The trilobed outline of the head is feebly developed and not divided, the middle lobe scarcely smaller than a lateral lobe. In *montanus* the trilobed outline is notably better developed and is distinctly divided. A *Heteronyx* from Queensland, in my collection, which has lost its hind claws and, therefore, cannot be confidently placed, is probably somewhat close to this species.

New South Wales; Sydney.

H. nudus, sp. nov. Modice elongatus, postice leviter dilatatus; sat nitidus; ferrugineus; supra pilis brevibus sparsissimis erectis vestitus; clypeo (hoc antice late emarginato) fronteque crebre subtilius rugulosis, ut plana valde disparia visis; labro clypei planum superanti; capite antice (a tergo oblique viso) tripliciter convexo (parte mediana quam laterales multo angustiori); antennis 9-articulatis, articulo 3o quam 4us paullo longiori; prothorace quam longiori ut 9 ad 5 latiori, antice sat angustato, supra sat crebre sat subtiliter punctulato (puncturis circiter 24 in segmenti longitudine), lateribus (superne visis) leviter arcuatis, sulco laterali antice sat dilatato, angulis anticis sat acutis sat productis posticis (superne visis) acute rectis, basi sat fortiter bisinuata, margine basali ad latera summa magis elevato; elytris fortiter sparsius punctulatis (trans elytron puncturis circiter 23); pygidio crebre fortius punctulato; coxis posticis quam metasternum sat multo brevioribus, quam segmentum ventrale 2um sat longioribus; tarsorum posticorum articulo basali quam 2us sat breviori, quam 3us vix longiori; unguiculis posticis appendiculatis, parte basali quam apicalis sat longiori. Long., 4½ l.; lat., 2¼ l.

Remarkable by the punctures of its pronotum very conspicuously finer and closer than those of its elytra. In this respect it resembles *H. Rothei*, Blackb., which is a considerably smaller species, with the hind angles of the prothorax though well defined notably less sharp than in *H. nudus*, the hind femora very differently sculptured, etc. The trilobed outline of the head is strongly defined and divided, the middle lobe about half of a lateral lobe in size.

Western Australia: Bridgetown (Mr. Lea).

H. impar, sp. nov. Modice elongatus, postice minus dilatatus; sat nitidus; niger, antennis (harum flabello testaceo), palpis pedibus corporeque subtus dilutioribus; supra fere glaber; clypeo sat crebre ruguloso, antice late vix emarginato; labro clypei planum superanti; capite antice (a tergo oblique viso) tripliciter convexo (parte mediana quam laterales paullo angustiori); fronte sat fortiter minus crebre nec rugulose punctulata; hac clypeoque ut plana valde disparia visis; antennis 9-articulatis, articulo 3o quam 4us paullo longiori; prothorace quam longiori ut 8 ad 5 latiori, antice sat fortiter angustato, supra sparsim subtiliter punctulato (puncturis circiter 12 in segmenti longitudine), lateribus (superne visis) pone medium sat fortiter rotundato-dilatatis, sulco laterali æquali, angulis anticis sat acutis modice productis posticis (superne visis) rotundatis, basi vix sinuata, margine basali subtili sat æquali; elytris fortius minus crebre punctulatis (trans elytron puncturis circiter 23); pygidio longitudinaliter carinato, fortius sparsius punctulato; coxis posticis quam metasternum sat multo brevioribus, quam segmentum ventrale 2um paullo longioribus; tarsorum posticorum articulo basali quam 2us sat breviori, 3o sat æquali; unguiculis posticis appendiculatis, parte basali quam apicalis multo longiori. Long., 3 l.; lat., 1½ l.

The punctures of the pronotum very much finer and less close than of the elytra will distinguish this species from all others (known to me) resembling it structurally Its small size and dark colour (if the colour is constant) are also very distinctive. The trilobed outline of the head is feebly defined, not divided, the middle lobe fully three-quarters of a lateral lobe in size.

North Queensland (Mr. Perkins).

H. hirsutus, sp. nov. Minus elongatus, postice leviter dilatatus; sat nitidus; ferrugineus; supra (præsertim in elytris et pronoti margine antico) pilis sat elongatis erectis vestitus; clypeo (hoc antice late emarginato)

fronteque (hac antice alte perpendiculari) sat crebre rugulosis; labro clypei planum superanti; capite antice (a tergo oblique viso) tripliciter convexo (parte mediana quam lateralium dimidium haud angustiori); antennis 9-articulatis, articulo 3º quam 4us sat longiori; prothorace quam longiori fere duplo latiori, antice minus angustato, supra subtilius minus crebre punctulato (puncturis circiter 18 in segmenti longitudine), lateribus (superne visis) perparum arcuatis, sulco laterali antice sat dilatato, angulis anticis acutis sat productis posticis (superne visis) sat acute rectis, basi leviter bisinuata, margine basali ad latera summa magis elevato; elytris sat fortiter minus crebre punctulatis (trans elytron puncturis circiter 26); pygidio fortius minus crebre punctulato; coxis posticis quam metasternum sat multo brevioribus, quam segmentum ventrale 2um haud multo longioribus; tarsorum posticorum articulo basali quam 2us multo, quam 3us parum, breviori; unguiculis posticis appendiculatis, parte basali quam apicalis sat longiori. Long., $4\frac{1}{5}$ l.; lat., $2\frac{1}{5}$ l.

Very easily distinguishable from its allies by the characters cited in the tabulation. The trilobed outline of the head is very well developed, and is divided, the middle lobe being about half of a lateral lobe in size. The punctures of the pronotum are considerably smaller than those of the elytra, but not conspicuously more closely or less closely placed.

Western Australia (exact habitat not known).

H. convexicollis, sp. nov. Modice elongatus, postice parum dilatatus; sat nitidus; obscure ferrugineus, palpis antennisque dilutioribus; supra fere glaber; clypeo crebre vix grosse ruguloso, antice late leviter emarginato; labro clypei planum vix superanti; capite antice (a tergo oblique viso) tripliciter convexo (parte mediana quam laterales sat angustiori); fronte sat crebre sat grosse parum rugulose punctulata; hac clypeoque ut plana sat dispara visis; antennis 9-articulatis, articulo 3º quam 4us vix longiori; prothorace quam longiori ut 7 ad 4 latiori, antice sat angustato, supra præter solitum convexo, subtilius sat sparsim punctulato (puncturis circiter 18 in segmenti longitudine), lateribus (superne visis) sat arcuatis, sulco laterali sat æquali, angulis anticis sat rectis parum prominulis posticis (superne visis) rotundato-obtusis, basi vix sinuata, margine basali æquali; elytris fortius minus crebre punctulatis (trans elytron puncturis circiter 22); pygidio longitudinaliter carinato, sparsim

subtilius punctulato; coxis posticis quam metasternum multo brevioribus, quam segmentum ventrale 2um paullo longioribus; tarsorum posticorum articulo basali quam 2us sat breviori 3o sat æquali; unguiculis posticis appendiculatis, parte basali quam apicalis multo longiori. Long., $3\frac{2}{5}$ l.; lat., $1\frac{3}{5}$ l.

Easily distinguishable among its nearer allies by its strongly convex, almost subgibbous, pronotum (very much more convex than that of *H. jubatus*). The trilobed outline of the head is feebly developed and not divided, the middle lobe about two-thirds of a lateral lobe in size.

North Queensland (Mr. Perkins).

H. calidus, sp. nov. Modice elongatus, postice parum dilatatus; sat nitidus; ferrugineus; supra pilis minus brevibus adpressis minus sparsim vestitus; clypeo crebre subtilius ruguloso, antice leviter emarginato; labro clypei planum vix superanti; capite antice (a tergo oblique viso) tripliciter convexo (parte mediana quam laterales sat angustiori); fronte rugulose sat fortiter sat crebre punctulata; hac clypeoque ut plana sat disparia visis; antennis 9-articulatis, articulo 3o quam 4us paullo longiori; prothorace quam longiori ut 7 ad 4 latiori, antice sat fortiter angustato, supra subtilius sat crebre punctulato (puncturis circiter 20 in segmenti longitudine), lateribus (superne visis) sat arcuatis pone medium dilatato-rotundatis, sulco laterali æquali, angulis anticis vix acutis parum prominulis posticis (superne visis) sat rotundatis, basi leviter bisinuata, margine basali æquali; elytris minus subtiliter sat profunde sat crebre punctulatis (trans elytron puncturis circiter 24); pygidio longitudinaliter carinato, sat fortiter punctulato; coxis posticis quam metasternum multo brevioribus, quam segmentum ventrale 2um paullo longioribus; tarsorum posticorum articulo basali quam 2us sat breviori, 3o sat æquali; unguiculis posticis appendiculatis, parte basali quam apicalis multo longiori. Long., 3-$3\frac{1}{2}$ l.; lat.. $1\frac{1}{2}$-$1\frac{3}{4}$ l.

This species is very close to *H. parvulus*, Macl. The punctures of its elytra are very distinctly and more strongly impressed, and its prothorax is less strongly rotundate-dilatate laterally behind the middle. It is, however, best distinguished by its longitudinally carinate pygidium. In both species there are differences in the pygidium which I believe to be sexual. In *parvulus* one sex (I believe it to be the male) has the pygidium very faintly and sparsely punctured, with an almost obsolete tubercle in the middle of its surface; while

in the other sex the pygidium is a little more strongly and closely punctured, with a faint impression on either side near the apex. In *calidus* the sex that I regard as male has the pygidium carinate, with sparse fairly strong puncturation; while in the other sex the pygidium is carinate, with still stronger and conspicuously closer punctures. It should also be noted that in *calidus* the elytra are transversely thickened, quite strongly, close to the apex, while in *parvulus* there is scarcely any trace of such structure. The trilobed outline of the head is feeble in both species, and not divided, the middle lobe about two-thirds of a lateral lobe in size. I have a specimen from Roebuck Bay too much mutilated to be justifiably described which seems to represent a distinct species very close to *calidus*.

North Queensland (Mr. Perkins).

H. inconspicuus, sp. nov. Sat elongatus, postice parum dilatatus; sat nitidus; ferrugineus; supra pilis adpressis minus brevibus vestitus; clypeo crebre ruguloso, antice late parum emarginato; labro clypei planum vix superanti; capite antice (a tergo oblique viso) tripliciter convexo (parte mediana quam laterales sat angustiori); fronte sat grosse parum rugulose punctulata; hac clypeoque ut plana minus disparia visis; antennis 9-articulatis, articulo 3° quam 4^{us} parum longiori; prothorace quam longiori ut 7 ad 4 latiori, antice sat angustato, latitudine majori prope basin sita, supra subtilius sat crebre punctulato (puncturis circiter 20 in segmenti longitudine), lateribus (superne visis) leviter arcuatis, sulco laterali sat æquali, angulis anticis sat rectis parum productis posticis (superne visis) rotundato-obtusis, basi leviter bisinuata, margine basali subtili æquali; elytris subtilius sat crebre punctulatis (trans elytron puncturis circiter 26); pygidio longitudinaliter carinato, sat crebre sat fortiter punctulato; coxis posticis quam metasternum multo brevioribus, quam segmentum ventrale 2^{um} paullo longioribus; tarsorum posticorum articulo basali quam 2^{us} sat breviori, 3° sat æquali; unguiculis posticis appendiculatis, parte basali quam apicalis multo longiori. Long., 3-3$\frac{2}{5}$ l.; lat., 1$\frac{2}{5}$-1$\frac{3}{5}$ l.

Easily distinguishable by the characters cited in the tabulation. The trilobed outline of the head is feebly developed and not divided, the middle lobe about two-thirds of a lateral lobe in size. The fine raised lateral edging of the elytra does not continue along the apex, but ends abruptly at the extero-apical corner.

New South Wales; Sydney, etc.

H. subcylindricus, sp. nov. Modice elongatus, postice vix dilatatus; modice nitidus; ferrugineus; supra pilis adpressis minus brevibus crebrius vestitus; clypeo (hoc antice sat emarginato) fronteque sat crebre rugulosis, ut plana sat disparia visis; labro clypei planum superanti; capite antice (a tergo oblique viso) tripliciter convexo (parte mediana quam laterales sat angustiori); antennis 9-articulatis, articulo 3° quam 4^{us} vix longiori; prothorace quam longiori ut 12 ad 7 latiori, latitudine majori vix pone medium sita, antice sat angustato, supra subtilius sat crebre punctulato (puncturis circiter 20 in segmenti longitudine), lateribus (superne visis) sat rotundatis, sulco laterali æquali. angulis anticis sat rectis vix productis posticis rotundatis, basi vix sinuata, margine basali subtili æquali; elytris crebre subtilius nonnihil aspere punctulatis (trans elytron puncturis circiter 30); pygidio longitudinaliter carinato leviter sparsius punctulato; coxis posticis quam metasternum sat multo brevioribus, quam segmentum ventrale 2^{us} paullo longioribus; tarsorum posticorum articulo basali quam 2^{us} paullo breviori, quam 3^{us} sublongiori; unguiculis posticis appendiculatis, parte basali quam apicalis multo longiori. Long., 3-3$\frac{1}{5}$ l.; lat., 1$\frac{1}{2}$-1$\frac{3}{5}$ l.

The fine raised edging of the elytra is as in *H. inconspicuus*, Blackb., from which the present species differs by numerous characters, especially the shape of the prothorax. If the prothorax be looked at from a point above, and a little in front of, the lateral margin (so that the whole lateral outline is visible) it will be seen that the point whence the curve begins to converge towards the apical angle and towards the extremity of the base is scarcely nearer to the base than to the apex, while in *inconspicuus* it is considerably nearer to the base. The trilobed outline of the head is very feeble and scarcely divided, the middle lobe fully two-thirds of a lateral lobe in size. This species is very like *H. concolor*, Macl., from which it differs by its form longer and more cylindric, the puncturation of its elytra closer and subasperate, its claws normally appendiculate, etc.

North Queensland; Kuranda (Mr. Dodd).

H. puer, sp. nov. Minus elongatus, postice vix dilatatus; minus nitidus; obscure ferrugineus, palpis antennisque dilutioribus; supra pilis adpressis minus brevibus vestitus; clypeo (hoc antice emarginato) crebre ruguloso; labro clypei planum vix superanti; capite antice (a tergo oblique viso) tripliciter convexo (parte mediana quam

laterales sat multo angustiori); fronte fortiter sat rugulose punctulata; hac clypeoque ut plana minus disparia visis; antennis 9-articulatis, articulo 3° quam 4^us^ paullo longiori; prothorace quam longiori ut 3 ad 2 (vix) latiori, latitudine majori vix pone medium sita, antice sat fortiter angustato, supra subtilius sat crebre punctulato (puncturis circiter 20 in segmenti longitudine), lateribus (superne visis) sat fortiter rotundatis, sulco laterali æquali, angulis anticis sat rectis parum productis posticis (superne visis) sat rotundatis, basi vix bisinuata, margine basali subtili æquali; elytris crebre subtiliter nec aspere punctulatis (trans elytron puncturis circiter 32); pygidio sparsius minus subtiliter punctulato; coxis posticis quam metasternum sat multo brevioribus, quam segmentum ventrale 2^um^ paullo longioribus; tarsorum posticorum articulo basali quam 2^us^ vix breviori, quam 3^us^ sat longiori; unguiculis posticis appendiculatis subbifidis, parte basali quam apicalis multo longiori. Long., 3 l.; lat., 1½ l.

This species is somewhat close to several others, notes on which will be found under the heading of the next species (*H milldurensis*); it can be identified with confidence I think by the characters indicated in the tabulation. Its subbifid claws and other characters cause it to resemble *H. subfuscus*, Macl. (Group VII.), from which it is easily distinguished, however, by its intermediate claws normally appendiculate, its notably smaller size, the smaller size of its elytral punctures (which have no tendency to be asperate), etc. The trilobed outline of its head is fairly well defined but not quite divided, the middle lobe a little more than half of a lateral lobe in size.

North Queensland (Mr. Perkins).

H. mildurensis, sp nov. Minus elongatus, postice parum dilatatus; sat nitidus; obscure ferrugineus, antennarum flabello testaceo, elytris piceo-umbratis; supra pilis adpressis minus brevibus vestitus; clypeo crebre subtilius ruguloso, antice leviter emarginato; labro clypei planum leviter superanti; capite antice (a tergo oblique viso) tripliciter convexo (parte mediana quam laterales sat angustiori) fronte sat fortiter minus rugulose punctulata; hac clypeoque ut plana minus disparia visis; antennis 9-articulatis, articulo 3° quam 4^us^ manifeste longiori; prothorace quam longiori ut 3 ad 2 latiori, latitudine majori vix pone medium sita, antice sat angustato, supra subtilius sat crebre punctulato (puncturis circiter 20 in segmenti longitudine), lateribus (superne visis) sat rotund-

atis, sulco laterali æquali, angulis anticis sat rectis parum productis posticis (superne visis) sat rotundatis, basi vix bisinuata, margine basali æquali; elytris sat subtiliter vix crebre punctulatis (trans elytron puncturis circiter 24); pygidio leviter minus crebre punctulato, longitudinaliter carinato; coxis posticis quam metasternum sat multo brevioribus, quam segmentum ventrale 2um paullo longioribus; tarsorum posticorum articulo basali quam 2us paullo breviori, 3o sat æquali; unguiculis posticis appendiculatis, parte basali quam apicalis multo longiori, variat corpore toto ferrugineo. Long., 3 l.; lat., $1\frac{2}{5}$ l.

The trilobed outline of the head is very feeble and not divided, the middle lobe about two-thirds of a lateral lobe in size The species of the aggregate AA, BB, CC, DD, EEE, FF, GG, are all obscure and small insects bearing much general resemblance to each other. I believe the characters indicated in the tabulation as distinguishing them, *inter se*, to be reliable and constant, but think it desirable to add some notes on some of their other distinctive characters. *H. concolor* and *suturalis* have a fringe of stout bristles at the apex of the elytra which is absent in the other species. I have seen a sufficiently long series of *H. calidus* and *inconspicuus* to satisfy me that the fringe is constantly absent in them, but it is possibly wanting through abrasion in some of the others. The elytral puncturation is very notably closer in *H. subcylindricus* and *puer* than in any other of the aggregate. *H. inconspicuus* differs from all the others of the aggregate in its prothorax being at its widest notably nearer to the base, with sides feebly arched and hind angles less rounded off. The pygidium is more or less strongly carinate in all except *H. oscillator*, *parvulus*, *suturalis*, and *puer*. *H. concolor* and *puer* alone have hind claws subbifid.

Victoria; Mildura.

SUPPLEMENT.

The following species must be added to Groups already treated in the present Revision. Most of them have been received since the publication of the Memoirs in which they must stand. On the pages following the descriptions some general remarks will be found, and also some notes on the described species that I have not been able to tabulate:—

Group II.

H. confertus, sp. nov. Sat elongatus, postice sat dilatatus; minus nitidus; piceo-ferrugineus, antennis palpis pedibusque dilutioribus; supra pilis adpressis sat brevibus

vestitus; pronoto pilis erectis elongatis antice fimbriato, et his in elytris prope basin distributis; clypeo (hoc antice rotundato) fronteque crebre sat fortiter rugulosis, planum sat æqualem efficientibus; antennis 8-articulatis; prothorace quam longiori ut 11 ad 7 latiori, antice fortiter angustato, supra confertim subtiliter subaspere punctulato (puncturis circiter 38 in segmenti longitudine), lateribus pone mediam partem sat fortiter rotundatis, angulis anticis sat acutis parum prominulis posticis (superne visis) subacutis, basi modice bisinuata, margine basali ad latera vix magis elevato; elytris confertim sat subtiliter subaspere punctulatis (trans elytron puncturis circiter 50); pygidio crebrius subtilius punctulato; coxis posticis quam metasternum sat brevioribus, quam segmentum ventrale 2^{um} sat longioribus; tibiis anticis extus tridentatis; tarsorum posticorum articulo basali quam 2^{us} paullo breviori quam 3^{us} parum longiori; unguiculis appendiculatis. Long., $6\frac{1}{2}$ l.; lat., $3\frac{1}{5}$ l.

In the tabulation of Group II. (Trans. Roy. Soc., S.A., 1908, p. 384) this species must stand beside *torvus*, Blackb., which it resembles considerably, differing, however, by, *inter alia multa*, the much sharper hind angles of its pronotum and the much closer and finer punctures of its elytra. It may be placed thus in the tabulation (under A, BB, C, D):—

E. Elytral punctures very close (20 from suture not reaching to middle) ... confertus, *Blackb.*
EE. Elytral punctures much less close (20 from suture considerably passing middle) ... ... torvus, *Blackb.*

It should be noted that the clypeus and frons do not present quite so even and continuous a surface as in *H. tristis*, Blackb., and *torvus*—which is also the case in *H. hispidulus*, Blackb. The pronotum in *H. tristis* is much less closely punctured than in this species and *torvus*.

Victoria; Dividing Range.

H. novitius, sp nov. Minus elongatus, postice leviter dilatatus; sat nitidus; obscure ferrugineus; supra pilis brevibus adpressis vestitus; pronoto pilis erectis sat elongatis antice fimbriato, nonnullis in elytris dispersis; clypeo (hoc antice late vix emarginato) fronteque crebre sat rugulosis, planum continuum efficientibus; labro clypei planum fere attingenti, a tergo oblique viso sat fortiter emarginato; antennis 8-articulatis; prothorace quam longiori ut 5 ad 3 latiori, antice parum angustato, supra subtilius sat crebre punctulato (puncturis circiter 22 in segmenti longitudine), lateribus (superne visis) minus

arcuatis, angulis anticis modice acutis sat productis posticis (superne visis) rectis, basi sat fortiter bisinuata, margine basali sat æquali; elytris sat crebre granulatis, squamose subtilius crebre punctulatis (trans elytron puncturis circiter 30); pygidio subtilius sparsius punctulato; coxis posticis quam metasternum sat brevioribus quam segmentum ventrale 2^{um} sat longioribus; tibiis anticis extus fortiter tridentatis; tarsorum posticorum articulo basali quam 2^{us} manifeste breviori quam 3^{us} paullo longiori; unguiculis appendiculatis. Long., $4\frac{4}{5}$ l.; lat., $2\frac{2}{3}$ l.

Easily distinguishable from all the previously described members of this Group by its labrum, which is considerably projected and is erect in front, but not quite reaching the level of the clypeus, the labrum visible when the head is viewed obliquely from behind, but with a concave outline. It could be placed in the tabulation (Trans. Roy. Soc., S.A., 1908, p. 384) as DDD in the aggregate A, BB, C, thus.—

DDD. Pronotum smoothly and closely, but by no means confluently, punctured ... ... novitius, *Blackb.*

The structure of its labrum could not be used to characterize it in the tabulation without the tabulation being entirely relettered. The membranous apex of the elytra (in the unique type) is strongly developed. In my former Revision this species would have stood in Group III. (now dropped).

New South Wales; Sydney (Mr. Lea).

H. coralis, sp. nov. Sat brevis, postice sat dilatatus; nitidus; ferrugineus; supra glaber; clypeo crebre sat fortiter ruguloso, antice late subtruncato; labro clypei planum nullo modo attingenti; fronte fortiter minus crebre vix rugulose punctulata; hac clypeoque ut plana valde disparia visis; antennis 8-articulatis; prothorace quam longiori ut 7 ad 3 latiori, antice parum angustato, supra sat fortiter minus crebre punctulato (puncturis circiter 12 in segmenti longitudine), lateribus (superne visis) modice arcuatis, angulis anticis sat acutis modice productis posticis (superne visis) acute rectis nonnihil deplanatis, basi leviter bisinuata, margine basali parum manifesto; elytris fere ut pronotum punctulatis (trans elytron puncturis circiter 20); pygidio crebre minus fortiter punctulato; coxis posticis brevissimis, quam segmentum ventrale 2^{um} sat multo brevioribus; tibiis anticis extus bidentatis; tarsorum posticorum articulo basali

quam 2^{us} manifeste longiori, quam 3^{us} sat multo breviori; unguiculis appendiculatis. Long., 3 l.; lat., $1\frac{3}{8}$ l.

I omitted this species when I was revising Group II. because I was disposed to consider it generically distinct from *Heteronyx*, but on further consideration its peculiar characters appear to me to be only exaggerations of what is to be found in species that certainly must not be separated from *Heteronyx*. Its prothorax is more strongly transverse and its hind coxæ shorter than those of any other *Heteronyx* known to me, and it is remarkable that these two characters should be present in one species. I think there is only one other *Heteronyx* (*H. setifer*, Blackb.) in which the basal joint of the hind tarsi is conspicuously longer than the 2nd joint. The puncturation of both pronotum and elytra is somewhat acervate. In the tabulation of this Group (Trans. Roy Soc., S.A., 1908, p. 384) this species will stand next to *H. brevicollis*, Blackb., from which it may be separated thus:—

E. Hind angles of prothorax obtuse ... brevicollis, *Blackb.*
EE. Hind angles of prothorax sharply
right angles ... ... coxalis, *Blackb.*

N.B.—The type of *H. coxalis* is perhaps abraded, but the species is certainly one with very little if any pubescence.

New South Wales: Gosford (Mr. Lea).

H. costulatus, Blackb. Sat elongatus, postice leviter dilatatus; nitidus; ferrugineus; sat glaber, pronoto pilis erectis sat elongatis antice fimbriato, nonnullis in capite elytrisque dispersis; clypeo grosse sat crebre ruguloso, antice subtruncato; labro clypei planum haud attingenti; fronte grosse nec crebre nec rugulose punctulata; fronte clypeoque ut plana sat disparia visis; antennis 8-articulatis; prothorace quam longiori duplo latiori, antice parum angustato, supra sparsim fortiter subacervatim punctulato (puncturis circiter 12 in segmenti longitudine), lateribus (superne visis) leviter arcuatis, angulis anticis sat acutis modice productis posticis (superne visis) obtusis, basi vix sinuata, margine basali sat æquali; elytris costulis circiter 5 (sutura inclusa, 5^{a} subobsoleta) ornatis, fortiter subseriatim minus crebre punctulatis (trans elytron puncturis circiter 18); pygidio subtilius minus crebre punctulato; coxis posticis quam metasternum sat brevioribus quam segmentum ventrale 2^{um} sat longioribus; tibiis anticis extus tridentatis; tarsorum posticorum articulo basali quam 2^{us} paullo breviori, 3^{o} sat æquali; unguiculis appendiculatis. Long., 3 l.; lat., $1\frac{3}{8}$ l.

In the tabulation (Trans. Roy. Soc., S.A., 1908, p. 384) this species must stand beside *spretus*, Blackb., from which it differs by, *inter alia plurima*, the (well defined) costæ on its elytra.

Western Australia; Mount Barker (Mr. Lea).

Group III.

H. aspericollis, Blackb. This species was accidentally omitted when Group III. was revised by me in Trans. Roy. Soc., S.A., 1909. In my former Revision of *Heteronyx* the species was placed in Group VI. (corresponding in general to Group VII. of the present memoir), but cannot stand in Group VII. as now characterized, on account of the middle lobe of the trilobed outline of the head not being convex, but of the same peculiar form as that of the species which I believe to be *H. granum*, Burm., *i.e.*, bisinuate with its ends angular. In the tabulation of Group III. (*loc. cit.*, pp. 21-24) *aspericollis* must stand beside *granum* from which it differs by, *inter alia*, the dark flabellum of its antennæ and the hind coxæ longer than the 2nd ventral segment. It also differs in colouring. I have before me a fairly numerous series of both species, and find that while the pronotum of *granum* is invariably testaceous-red in colour, that of *aspericollis* is invariably black, although its elytra vary in colour from red to black with an intermediate form having the suture (only) black.

H. granum, Burm. It seems desirable to call attention here to the note in my former Revision on the difficulty of identifying this species (Proc. Linn. Soc., N.S.W., 1889, p. 1235). As Burmeister did not describe the claws of *H. granum* confident identification is impossible. The species to which I have assigned the name is variable in colour, the elytra being much darker in some specimens than in others. It is found in Victoria as well as in South Australia.

H. alienus, Blackb. This species was accidentally overlooked when Group III. was revised in Trans. Roy. Soc., S.A., 1909. Its proper place in the tabulation is in the aggregate GG on page 24, line 4. It differs from both the other species in that aggregate by its clypeus very distinctly emarginate in front—as in *H. æqualiceps*, Blackb.—(very much less strongly than in *H. obesus*, Burm.), by its much smaller size, its pronotum and elytra much more coarsely and less closely punctured, etc., etc. In the tabulation it should follow *H. Callabonnæ*, Blackb., thus:—

HHH. Clypeus very conspicuously emarginate in front ... . alienus, *Blackb.*

Group IV.

H. ruficollis, Macl This species should be placed here. I have recently examined the unique type (in the Australian Museum, Sydney) which, unfortunately, is in very bad condition, appearing to have been broken and subsequently reconstructed with gum. There are, however, some unnamed specimens in the Macleay Museum, from Cairns, which seem to be identical. Assuming their identity, the species falls in Group IV. (Subgroup II.) of the present Memoir, where it stands in the tabulation beside *H. additus*, Blackb., differing from that species by, *inter alia*, its very much smaller size, clypeus not projecting laterally beyond the outline of the eyes, and lateral sulcus of the pronotum not dilated in its front part. *H. ruficollis* is extremely variable in colouring of elytra from the "black" of the type to testaceous, with intermediate forms in which the elytra are black with a wide discoidal red vitta, the vitta in some examples being abbreviated so as to be a mere red blotch on the middle of the base.

H. grandis, Blackb. In the tabulation of the 2nd subgroup of Group IV. (Trans. Roy. Soc., S.A., 1909, pp. 44, etc.) this species might perhaps be more satisfactorily placed by transposing the lines (on p. 44) D and E, EE, so that E and EE would become D and DD, and would immediately follow C, the line now standing as D becoming E, and following next after the line now called EE. That change would involve the alteration of the lettering on p. 47 by DD becoming EE, and the next six lines becoming F, G, GG, H, HH, FF. The change would be for the purpose of avoiding the statement that the frons of *H. grandis* is not perpendicularly declivious—a statement that cannot be made correctly without qualification, inasmuch as the frons is perpendicular for a certain distance on either side part of its front margin and rarely is slightly so even in the middle. I have recently taken (in the original locality) a small *Heteronyx* (long., 4½ l.) which, I have no doubt, is a dwarf of *H. grandis*, and its frons certainly proves that it is possible for the declivity to be quite traceable all across the front.

H. cornutus, sp. nov. Modice elongatus, postice sat dilatatus; sat nitidus; ferrugineus; supra pilis adpressis minus brevibus minus crebre vestitus; clypeo crebre nec grosse ruguloso, antice ut lamina sat alta erecta angusta reflexo, in exteriorem partem oculos fortiter superanti; labro clypei planum nullo modo attingenti; fronte sat grosse rugulosa; hac clypeoque ut plana disparia visis; antennis 9-articulatis; prothorace quam longiori ut 5 ad

3 latiori, antice modice angustato, supra minus crebre sat grosse punctulato (puncturis circiter 12 in segmenti longitudine), lateribus (superne visis) sat rotundatis, angulis anticis minus acutis minus productis posticis (superne visis) sat rotundatis, basi haud sinuata, margine basali subtili æquali; elytris minus crebre sat grosse punctulatis (trans elytron puncturis circiter 16); pygidio sparsius minus fortiter punctulato: coxis posticis quam metasternum manifeste brevioribus, quam segmentum ventrale 2um sat longioribus; tarsis brevibus, posticorum articulo basali quam 2us paullo breviori 3o sat æquali; unguiculis posticis appendiculatis, vix subbifidis, parte basali quam apicalis multo longiori. Long., 2¼ l.: lat., 1⅛ l.

This and the following two species display a character which distinguishes them sharply from all the rest of the known Australian *Heteronyces*, in the clypeus being raised in front into an erect narrow lamina, the height of which is equal to about half the distance from its base to the clypeal suture. The claws of all three are appendiculate, but more or less (least in this species) of the subbifid type discussed under the heading of Group IV. (Trans. Roy. Soc., S.A., 1909, p. 39). They belong to the 2nd subgroup of Group IV., and their place in the tabulation of that subgroup is indicated under the heading of *H. pedarius*, Blackb. The punctures of the dorsal surface in this species are not numerous, but owing to their large size they are tolerably close to one another.

North-Western Australia (given to me by Mr. French).

H. capitalis, sp. nov. Modice elongatus, postice leviter dilatatus; sat nitidus; dilute ferrugineus; supra pilis adpressis minus brevibus minus crebre vestitus, capillis erectis sat elongatis nonnullis in capite et in pronoti parte antica dispersis; clypeo (hoc antice ut lamina sat alta erecta minus angusta reflexo, in exteriorem partem oculos haud superanti) fronteque crebre nec grosse rugulosis, ut plana disparia visis; labro clypei planum nullo modo attingenti; antennis 9-articulatis; prothorace quam longiori ut 5 ad 3 latiori, antice modice angustato, supra crebre subtiliter punctulato (puncturis circiter 25 in segmenti longitudine), lateribus (superne visis) sat rotundatis, angulis anticis sat acutis modice productis posticis (superne visis) rotundatis, basi vix bisinuata, margine basali subtili sat æquali; elytris crebre subtiliter nec aspere punctulatis (trans elytron puncturis circiter 33); pygidio coriaceo sparsissime subobsolete punctulato; coxis posticis metasterno longitudine sat æqualibus, quam segmentum ventrale 2um multo longioribus: tibiis anticis

extus bidentatis; tarsis sat brevibus, posticorum articulo basali quam 2^{us} sat breviori 2^{o} sat æquali; unguiculis posticis appendiculatis sed subbifidis, parte basali quam apicalis paullo longiori. Long., $3\frac{2}{5}$ l.; lat., $1\frac{3}{5}$ l.

Some remarks on the characters of this species will be found under the preceding (*H. cornutus*). It differs from *H. cornutus* by larger size, the very dissimilar puncturation of its dorsal surface, its clypeus not passing the outline of the eye laterally, its front tibiæ with only two external teeth, the apical piece of its hind claws notably longer, etc. The shape of the pseudo-horn of its clypeus is fan-shaped, being (when viewed obliquely along the head from behind) much narrower at the base than the apex, which has a convex outline, the pseudo-horn of *cornutus* having sides almost parallel and apex subtruncate.

North Queensland (Mr. Perkins).

H. pedarius, sp. nov. Sat elongatus, postice parum dilatatus; minus nitidus; dilute ferrugineus; supra pilis adpressis minus brevibus crebrius vestitus, capillis erectis sat elongatis nonnullis in capite et in pronoti parte antica dispersis; clypeo (hoc antice ut lamina sat alta erecta minus angusta reflexo, in exteriorem partem oculos haud superanti) fronteque crebre nonnihil subgrosse rugulosis, ut plana minus disparia visis; labro clypei planum nullo modo attingenti; antennis 9-articulatis; prothorace quam longiori ut 7 ad 4 latiori, antice minus angustato, supra crebre sat subtiliter punctulato (puncturis circiter 25 in segmenti longitudine, lateribus (superne visis) sat fortiter rotundatis, latitudine majori ad mediam partem sita, angulis anticis sat acutis modice productis posticis (superne visis) sat rotundatis, basi perparum bisinuata, margine basali subtili sat æquali; elytris crebre subtiliter sat aspere punctulatis (trans elytron puncturis circiter 35); pygidio leviter sparsissime punctulato; coxis posticis metasterno longitudine sat æqualibus, quam segmentum ventrale 2^{um} multo longioribus; tibiis anticis extus bidentatis (dente superiori subobsoleto): tarsis minus brevibus, intermediorum articulo basali quam 2^{us} 3^{us}que conjunctis vix breviori, posticorum articulo basali 2^{o} sat æquali quam 3^{us} sat longiori; unguiculis posticis appendiculatis sed nonnihil subbifidis, parte basali quam apicalis sat longiori. Long., $3\frac{1}{5}$ l.; lat., $1\frac{2}{5}$ l.

The unusual length of the basal joint of the intermediate tarsi renders this species very distinct from the two others having the clypeus laminated, and its laminated clypeus distinguishes it from all the rest of the genus. It is nearly

allied to *H. capitalis*, from which it differs by, *inter alia*, its prothorax widest at the middle, its elytral puncturation asperate, etc. It, and the preceding two species, in the tabulation (Trans. Roy. Soc., S.A., 1909, p. 48) follow *pygidialis*, thus:—

BBB. Clypeus raised into a narrow erect lamina in front.	
C. Clypeal lamina with parallel sides; puncturation coarse and sparse .	cornutus, *Blackb.*
CC. Clypeal lamina more or less fan-shaped; puncturation fine and close.	
D. Basal 2 joints of intermediate tarsi subequal	capitalis, *Blackb.*
DD. Basal joint of intermediate tarsi very much longer than 2nd joint	pedarius, *Blackb*

North-Western Australia (Mr. Masters).

The number of names under which species have been described as *Heteronyces*, or which there is reason to attribute to the genus, although differently placed by their authors, is, I think, 328, including the new species described in this present Memoir. Of these names 293 will be found in the tabulations above (161 as previously described species, 131 as new species). The 35 names omitted from tabulation are accounted for as follows:—

Synonyms (10), *viz.*:—

australis (Cotidia), Boisd. *(nom. præocc.)* = *fallax*, Blackb.

breviceps, Blackb. = *rufopiceus*, Macl.

fissiceps, Blackb. = *chlorotica*, Gyll.

hepaticus, Er. = *fumatus*, Er. (*vide* Trans. Roy. Soc., S.A., 1901, p. 22).

obscurus, Le Guill. = *nigellus*, Er.

pubescens, Macl. = *Erichsoni*, Blackb.

rapax, Blackb. = *fumatus*, Er.

Cowelli, Blackb. = *concolor*, Macl.

submetallicus, Blackb. = *Lindi*, Blackb.

subvittatus, Macl. = *subfuscus*, Macl.

Subsequently made the type of a new genus (1), *viz.*:—

baldiensis, Blackb. (*Pseudoheteronyx*).

Species unknown to me, and not sufficiently described for confident identification (21). It seems desirable to furnish notes on these separately. They are:—

rotundiceps, Blanch. (already discussed under Group I.).

Spadiceus, Burm. (already discussed under Groups I. and VI.).

unguiculatus, Burm. (already discussed under Group I.).

pilosellus, Blanch. (already discussed under Groups III. and IV.).

laticeps, Burm. (already discussed under Groups III. and IV.).

australis, Guèr. (already discussed under Groups IV. and VIII.).

planatus, Burm. (already discussed under Group IV.).

unicolor, Blanch. (already discussed under Group VI.).

pellucidus, Burm. (already discussed under Group VII.).

Carpentariæ (Schizonycha), W. S. Macleay, Dej. Cat. Quoted by Gemminger and Harold as a synonym of *præcox*, Er., which, judged by the name, seems most improbable. The description given by Boisduval consists of five words.

cervinus (Sericesthis), Boisd. In Trans. Roy. Soc., S.A., 1907, p. 245, I mentioned having inspected a *Heteronyx* in the Macleay Museum which seemed to be a cotype of this species. At a later date I could not find the specimen.

holomelænus, Blanch. A member of Group VII. or VIII., according as its claws are bifid or appendiculate. It is described as entirely black and of fairly large size (10 m.). I do not know any such species in either Group.

laticollis, Blanch. Group VII. or VIII. (its claw structure not recorded). I should judge it, from the description, to belong to Group VIII., aggregate AA, B, C, D, E, in which it might be almost any of the species that I have placed there were it not that the prothorax is said to be wider than the elytra, which is not the case in any species known to me of the aggregate.

nigritus, Blanch. Group VII. or VIII. (its claw structure not recorded). It might be the species which I described as *H. nigrinus* were it not for the words "*elytris fere planis*" in the description. The locality is given as "Eastern Australia"; *nigrinus* is from Adelaide.

oblongus, Blanch. Group VII. or VIII. (its claw structure not recorded). The description fits many species in either group, and contains no

information by which the insect could be identified.

obscurus (Hombr. et Jacq.), Blanch. Group VII. or VIII. (its claw structure not recorded). Described as of moderate size (9 m.) and black colour, from the Northern Territory. I do not know any black species, of either group, from that region.

ovatus, Blanch. Group VII. or VIII. (its claw structure not recorded). The description mentions no really salient character, and fits more or less closely many species in either group.

pilosus (Hombr. et Jacq.), Blanch. Group VII. or VIII. (its claw structure not recorded). Habitat not recorded by Blanchard, but assigned in Masters' Catalogue to the Northern Territory. The description is not precise enough for identification with any *Heteronyx*.

proximus, Burm. Group VII. or VIII. (its claw structure not recorded). I do not think it would be possible to identify this insect by means of the description.

rufomarginatus, Blanch. Group VII. or VIII. (its claw structure not recorded). The description of this species does not fit any *Heteronyx* known to me.

rubriceps, Blanch. Group VII. or VIII. (its claw structure not recorded). Probably the type is immature or a variety. The description suggests a species of Group VIII., aggregate AA, B, C, D, E, but the description does not supply information that identifies it with any species of that aggregate.

The following species stand in this Revision of *Heteronyx* in different Groups from those in which they were placed in my former Revision. For my former Revision Sir W. Macleay was good enough to send me for inspection alleged specimens of many of the species that he described, and I treated them as types. Subsequent study in Sydney of the Macleay collections has, however, shown that it is not unusual for more than one species to stand in those collections under one name, and in some instances the specimen sent by Sir W. Macleay seems to have been the wrong one, and that circumstance accounts for some of the entries in the following list. One of the entries

arises from a mistake on my own part (*H. insignis*, Blackb), the others from slight changes in the terms used for definition of certain characters (chiefly those of the claws):—

H. rufopiceus, Macl., transferred from Group I to III.

H. insignis, Blackb., transferred from Group II to IV.

H. holosericeus, Macl., transferred from Group III. to IV.

H. badius, Macl., transferred from Group I. to VIII.

H. concolor, Macl.

H. simulator, Blackb., transferred from Group III. to IV.

H. Cowelli, Blackb., already discussed under Group VII.

H. siccus, Blackb , already discussed under Group VII.

H. sydneyanus, Blackb., transferred from Group VIII. to IV.

It should be borne in mind that in the first paper of my former Revision (Proc. Linn. Soc., N.S.W., 1888, pp. 1321, etc.) the aggregates that I subsequently called Groups I.-IV. were not divided into Groups, but included in one tabulation; also, that the aggregate which I then called "2nd section (Intermediate)" has now been cancelled, its species being distributed among the aggregates now named Groups.

The following three species are not included in the tabulations, as they require further study at Sydney before I can deal with them:—*H. marginatus*, Blackb.; *scutatus*, Macl.; *nigricans* (? Burm.), Blackb.

Description of a New and Extensive Area of Permo-Carboniferous Glacial Deposits in South Australia.

By Walter Howchin, F.G.S., Lecturer in Geology and Palæontology in the University of Adelaide.

[Read July 5, 1910.]

Plates XXXI. to XLV.

Contents.

I. INTRODUCTION.

Papers have already been read before this Society on the Permo - Carboniferous glacial phenomena of Hallett's Cove, Yorke Peninsula, Kangaroo Island, Cape Jervis, Yankalilla, the Inman and Hindmarsh Valleys, Rosetta Head, and King's Point. The present paper deals with the extension of these glacial beds in an easterly direction, and concerns mainly the highlands and swamps situated to the south of the Willunga Range, the basin of the River Finniss, and other lines of drainage which find their outlets into the valley of the River Murray. The region includes portions of the Hundreds of Kondoparinga, Myponga, Nangkita, Goolwa, and Encounter Bay.

The glacial beds now under consideration possess characteristics similar to those already described on the western side, and, at some points, these respective glacial areas are continuous. There are, however, minor points of difference between the two districts which may be mentioned. On the eastern highlands and their slopes towards the valley of the River Murray the larger erratics of granite, etc., so characteristic a feature in the western country, are almost entirely absent, and in the case of those erratics that do occur, granite boulders are relatively scarce. An explanation for these differences will probably be found in the contrasted topo-

graphical features of the respective areas as well as in a variation of the ice-flows. It would follow as a matter of course that the higher plateaux would be covered with a thinner ice-sheet than the valley troughs, in which latter the heaviest work of ice-quarrying would take place. It is also possible that the ice-sheet which reached the eastern side of the ranges came from a somewhat different direction and passed over different country than the western portions; and, if so, some diversity in their respective morainic material might be expected. Another possible explanation might be suggested in that the large erratics are mostly included in the true boulder clay of the Inman and associated districts, whereas in the eastern districts this lower bed has been but slightly eroded and exposed.

Much light would be thrown on this part of the subject if portions of the glaciated pavement were discovered carrying toolmarks, which would at once settle the question of the local lines of dispersion. At present no such exposures of the glacial floor are known to occur in the district. Great thicknesses of morainic material occupy the depressions and obscure the bed-rock, except in the greater heights which rise above the sandy country; but in such cases the immediate junction between the old rocks and overlying glacial beds is usually covered by a talus, resting on a steep slope, which prevents observations of the kind desired. The outcrops have been but imperfectly examined, and a search with this specific object in view might possibly lead to the discovery of the evidences referred to.

II. PHYSIOGRAPHICAL.

The country indicated above may be regarded as a physiographical province, bounded by the Willunga Ranges on the north, the neighbourhood of Currency Creek on the south, Hindmarsh Valley on the west, and the River Murray Valley on the east. It forms the water-parting between the east and west drainages; the River Finniss, the Black Swamp, and Currency Creek flowing in the former direction, and the Myponga River in the latter (see map, plate xxxi).

The traveller, after climbing Kernick's Hill, from Willunga, crosses the Willunga Ranges and enters a large basin which must impress even the casual observer as possessing striking features, and, in some respects, unlike any other portions of the State. A wide sandy valley is in front of him, in which the head-waters of the Rivers Finniss and Myponga overlap each other and compete for the drainage of the flat watershed (plate xxxii.). On the southern side of this valley there rise the rounded forms of Mounts Com-

pass, Effie, and Moon, consisting of Pre-Cambrian rocks, and are monadnocks of Permo-Carboniferous erosion. Around these hills is a weird-looking country of sandy ridges and treacherous swamps, covered with a characteristic scrub except where the settler has made a clearance and built his hut.

Passing through Mount Compass Gap we get a better view of this remarkable basin, which forms the north-west portions of the Hundred of Nangkita (plate xxxiii.). Mount Moon is directly in front, and forms a striking feature in the landscape. It rises abruptly from the plain, has a rounded contour, and is sharply truncated on its western side (plate xxxiv.). Mounts Compass and Effie have also rounded outlines with abrupt sides. All these hills have been submerged by glacial waste, and as the latter is easily removed by a feeble surface drainage the locality supplies excellent illustrations of "wind-gaps."

Mount Moon, as well as most of the other elevations of the district, is surrounded by swamps which converge in their drainage, forming the Black Swamp, a permanent stream of fresh-water, which finds its outlet by the lower reaches of the River Finniss.

The greatest elevation of the district is Mount Jagged, a rugged ridge of very siliceous white quartzite, representing the same geological horizon as Mount Magnificent, the range continuing therefrom to the north-east, to Bull's Creek and the Meadows. The quartzite of these ranges is not, stratigraphically, far above the base of the Cambrian series. Wood Cone is a slightly lower height on the northern sides of Mount Jagged, and consists of highly-metamorphosed slates which have weathered into good and deep soil. A greater contrast of physical conditions, within so short a distance, is rarely met with, as is seen on the slopes of Wood Cone. After toiling over loose sand, which supports a stunted scrub vegetation, the traveller suddenly emerges from this desert-like country to a rich, strong soil with running waters, and the extensive and well-kept orchards of the Messrs. Hancock, at Heywood, which rise like an oasis from the sandy wastes (plate xxxv.). Mount Jagged and Wood Cone were at one time buried under soft sandstones of glacial origin, but, like the lesser prominences of Mounts Compass and Moon, they have been partially cleared by denudation of the newer deposits and now form inliers of these beds.

A striking feature of this district is the numerous swamps which occupy the flats between the hills, a feature which distinguishes it from all other highlands of South Australia. Before visiting the district I had a strong convic-

tion that these swamps possessed a special geological significance, but in what way I could not tell. On examination it was found that the water, spreading over the flats, was supported by an impervious clay, more or less stony, and that this clay was overlain by a porous sandstone or loose sand, often of considerable thickness. The origin of the swamps was thus self-evident. The absorbent sandstone of the hills stores the rain which ultimately finds it way down to the clay-bed, and the latter, being exposed by denudation along the lines of drainage, collects on its surface the waters oozing from the banks and thereby causes a swamp.

The very youthful characteristics of the present drainage of the district cannot fail to attract the notice of the physiographist. Not only is the Mount Compass basin largely filled with incoherent or soft material, but the main streams are still flowing over soft clays on which, at present, they have made but slight impression. It is true the absorbent properties of the superficial beds limit the denuding force of the rains, and the rank growth of the swamps checks the movements of running water, until erosion is reduced to zero, yet it is remarkable that these ancient sediments of Permo-Carboniferous age should exhibit such youthful features in their present stage of erosion. Similar evidences are afforded by the short, torrential streams which flow down the steep sides of the Pre-Cambrian inliers, for these have but slightly incised the sides of the hills they drain, and thereby register only a relatively brief period since the removal of the protecting glacial deposits and the exposure of the older rocks to atmospheric waste.

The inliers of older rocks possess rounded outlines and are lineal to the main valley as well as parallel to each other. These features, together with the absence of spurs from the sides of the ranges, establish a strong probability that the topographical outlines of the older rocks were shaped under glacial erosion.

From the amount of glacial moraine still filling the depressions of the Mount Compass district, as well as forming parts of its watershed, it is difficult to define the main channels of the old Palæozoic valley. The abundance of water at or near the surface has made it unnecessary to sink deeply for supplies, so that the thickness of the glacial clay has not been proved. Judging by the outcrops of the older rocks, the deeper parts of the Palæozoic valley lie between the Black Swamp and Currency Creek, for in this belt of country the older rocks do not show at the surface.

The regional subsidence of the southern portions of the continent, in Post-Palæozoic times, had the effect of reversing

the drainage. Previously to this crust-movement, the streams of the present maritime districts drained to the north, but when a southerly tilt was given to the land, as a consequence of the great submergence, the drainage was directed to the south, as at present. The Permo-Carboniferous ice-sheet travelled up the present valley of the Inman, from south to north, which is proved by the travel of erratics in that direction: and there is little doubt that the ice which filled the basin of the Finniss also came from some points of the south, and, after blending with the great Inman Valley glacier, travelled north-westerly, till it formed a junction with the still greater body of ice which filled the valley now occupied by the sea in Gulf St. Vincent.[1]

III. GLACIAL.

(a) Stratigraphical Divisions.

Lithologically, the glacial beds maintain a striking uniformity throughout the district. They can be roughly divided into two divisions:—

(1.) An upper section, chiefly arenaceous, consisting of soft sandstones, hard sandstones, coarse gritty sandstones, often containing rounded stones, some of which measure a foot or 18 in. in diameter; these beds weather readily when exposed, producing free sand and pebbles passing up into a light, thin, sandy soil. A thick, black, peaty soil commonly occurs in swamps along the lines of drainage.

(2.) A lower section, chiefly clay, including more or less of sand in irregular bands or patches scattered through the clay. The clay, in exposed positions, has a yellow colour, but at a slight depth is blue. Pebbles occur sporadically through the clay or in pockets.

The dividing line is not sharply defined between the two sets of beds, but it may be taken as a general characteristic that sands prevail in the upper and clay in the lower section. Many of the sandy ridges are capped by ferruginously-cemented sands and conglomerates. The ferric oxide has probably been a later introduction.

The glacial district now under consideration is naturally divisible into two areas: (1) the Mount Compass and Nangkita Basin, and (2) the Finniss Basin.

(b) Mount Compass and Nangkita Glacial Basin.

The peculiar physiographical features of this basin have already been described. So far as the clays of the *lower set*

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(1) A review of the physical features of this district in their broader aspects, and the remarkable survival of so ancient a physiographical cycle, will be dealt with in a subsequent paper.

of beds (the boulder clay of other districts) are concerned, they scarcely come into view. They are seen in the channels which have been cut to drain the swamps, in the road cuttings near the Mount Compass township, and in some of the creeks which drain the swamps, especially those of Cleland's Gully and the Black Swamp. Along these lines of drainage settlers have confined the running water to definite channels which has promoted erosion and led to the deepening of the beds of the creeks, thereby exposing the clay-beds, but the exposure is trifling, and but little definite information can be gathered with reference to the beds. The stones thrown out from the drains were carefully examined and, in some instances, were found to be ice-marked.

The swamps throughout the district may be considered to represent, stratigraphically, the upper portions of the glacial clay-beds. Their principal occurrences are as follow:—*(a)* To the west of Mount Compass township; *(b)* surrounding Mount Moon and extending easterly into the Black Swamp; *(c)* Cleland's Gully, with its lateral branches, also draining into the Black Swamp; *(d)* swamps on either side of the main road, including the Square Waterhole; and *(e)* on the north-east side of the Hundred of Nangkita, parallel with the Bull's Creek Road. The Black Swamp is the natural outlet for the drainage of this country, and gives sections of the clay-beds at various points in its course. They can be studied just above the railway bridge at Black Swamp railway siding. Similar swamp country passes over into the Hundreds of Myponga and Encounter Bay. The Edinburgh Swamp, in the last-named Hundred, is of considerable extent, but the drainage from these Hundreds finds an outlet to the south or west.

The *upper members of the glacial series* form the dominant geological features of the country. From whatever standpoint the basin is viewed, the characteristic white, sandy soil can be recognized, and as the upland soils are poor it is, for the most part, still in a virgin condition covered by a thick and dwarf scrub.

From the northern slopes of Mount Compass a commanding view is obtained of the sandy flats which form the inappreciable water-parting between east and west, already referred to (plate xxxii.). From Mount Moon, near the centre of the basin, a panoramic view of great extent and striking features is obtained. To the west, the land rises in a sandy slope about 300 ft. in height, forming the dividing ridge between the Hundreds of Nangkita and Myponga (plate xxxvi.). On the south-east, between Mount Moon and Cleland's Gully, is a ridge of about the same elevation as the last-

named composed of glacial sandstones and pebbles (plate xxxvii.); and a similar ridge occurs on the south side of Cleland's Gully, forming the dividing line between the Hundreds of Nangkita and Goolwa. Looking to the south, the same kind of country fills the whole field of vision, rising in successive ridges up to 200 ft. in height. The main South Road follows the low ground between the ridges and passes over the saddle of one of these into the Hundred of Goolwa.

It was on the northern slopes of this dividing ridge, not far from the highest point on the road, that I obtained the first unquestionable proofs of glaciated stones within the area. On the western side of the road, occupying the slopes of the hills, a succession of shallow quarries occur. The stone is a fairly hard, gritty sandstone, with pebbles irregularly scattered through the finer matrix (plate xxxviii.). The included stones consist mostly of rounded quartz and quartzite of varying sizes up to 2 ft. in diameter. A few granite erratics, from 9 to 12 in. in diameter, were noted: but these were in a rotten condition and disintegrating. The included stones are, for the most part, of an exceedingly hard type, not easily scratched, but are frequently polished, some very highly so. Several were found with one or more faceted surfaces forming angular boundaries with the rest of the stone, and one or two carried distinct glacial striæ (plate xl.). The quarries are worked in successive steps or platforms, giving a maximum height of about 12 ft., but in all cases the floor was in the same class of rock which to all appearance went down indefinitely. The beds showed a dip slope of 15° to the north-east, which accorded with the general slope of the hillside. The stone is worked for road metal—a stretch of several miles of the main road is entirely maintained by the application of this material. The stone is exactly similar to that obtained from the Government Quarry, Wood's Creek, near Yankalilla, which is also utilized for a similar purpose throughout that district.

The glacial beds pass southwards into the Hundred of Goolwa, occupying the upper part of the Currency Creek basin. Their southern limit, in that direction, appears to be where the most southerly branch of Currency Creek cuts the main road, about seven miles from Mount Compass township.

The westerly limits of the Mount Compass basin are determined by a ridge which forms the watershed of the country, as well as the dividing line between the Hundreds of Nangkita and Myponga. This ridge, except where the older rocks form inliers, consists of the upper members of the glacial beds which pass over into the Myponga district and form the prevailing geological deposits of that Hundred. Near the upper part

of the ridge, just referred to, the glacial beds skirt the orchards of Heywood, the residence of Mr. Hancock, sen., near the summit of Wood Cone, close to Mount Jagged, where they reach an elevation of more than 300 ft. above the valley, and are within 100 ft. of the height of Mount Jagged. A small quarry has been opened in these beds near Mr. Hancock's house (for mending the road), from which I obtained a very fine faceted and striated boulder of black quartz, 8 in. in length. There can be no doubt that Wood Cone was at one time buried under glacial waste in common with the surrounding district. It owes its present freedom from such ice-borne material on account of the steepness of its sides and the force of running water which has deeply scored its flanks. Mount Jagged is also free from morainic deposits, but these are met with on the southern slopes of the range, covering a large area and passing westerly into the Hundred of Encounter Bay.

On the eastern side of the basin are two conspicuous ridges entirely composed of glacial sandstones (or their waste), and surrounded by swamps, as already described. Cleland's Gully divides the two ridges and forms the main artery of drainage for the district. The ridge on the southern side of Cleland's Gully is about 150 ft. in height, and forms the dividing line between the Hundreds of Nangkita and Goolwa.

The presence of pebbles is a characteristic feature of the district. They occur *in situ* in the clay of the lower members of the series as well as in the sandstones of the upper members and in the loose sand that has resulted from the disintegration of the beds. They occur, moreover, at all elevations, even on the summit of Mount Compass and other heights, in positions where the finer, sandy material has been entirely removed by denudation. They are mostly varieties of quartz (a black variety being not uncommon), close-grained quartzites, and a few granites. Clearly-defined examples of the local Pre-Cambrian rocks, among these pebbles, are rare. The stones are intensely waterworn, some being almost spherical or oblate spheroids in shape. None of these stones pertaining to the glacial beds of the Mount Compass basin were observed more than 18 in. or 2 ft. in diameter, and stones of this size were not often met with. Pebbles were found to be specially abundant on the south side of Mount Effie. Here they had evidently been concentrated by wind action; the finer material had been carried away by the wind and the stones left behind.

Mr. Hancock informed me that the pebbles were usually more abundant on the western than on the eastern slopes of

the hills, the explanation of which may be that the strong and prevailing westerly winds have a tendency to bare the ground on the exposed side, whilst the wind - driven sand gathers on the eastern or lee side of the hills.

(c) THE GILES CREEK AND RIVER FINNISS GLACIAL BASIN.

Physiographical.—The glacial basin of the Finniss is situated to the north-east of the Mount Compass and Nangkita basin, and is continuous with it. It includes, in addition to the main valley of the River Finniss, the lower portion of Bull's Creek from the point where it emerges from the Bull's Creek Ranges; and the still more important Giles Creek, which flows through glacial sandstones throughout almost its entire course, forming a junction with the River Finniss above Queen's Own Town.

The basin is surrounded by hills of Cambrian slates and quartzites finding their greater elevations in the Mount Magnificent and Bull's Creek Ranges, Gemmell's Hill, Giles Hill, and lesser heights near Strathalbyn. A ridge of old rocks, with Morphett's Hill and Mount Observation as principal heights, occupy the centre of the basin, and is entirely surrounded by glacial beds. The basin is open to the south-east, where it presents a wide front to the Murray flats, and the glacial beds become obscured in that direction by newer deposits.

The River Finniss has already been described as taking its rise on the flat and sandy watershed between Mount Compass and the Willunga Range. As this wide valley is occupied by glacial deposits, it is probable that it represents surface features that were contemporaneous with those deposits. It is a good example of physiographical unconformity, for it is clear that the existing streams have played no part in excavating the primary valley.

The River Finniss pursues a very erratic course. It first forms a loop, doubling upon itself, and then flows easterly along the base of the Mount Magnificent Range with glacial country on its southern side. On entering the Hundred of Kondoparinga it takes a northerly course, following the base of the same range till within a mile of Ashbourne, where it turns sharply to the east and, forsaking the valley, cuts a deep gorge through the old rocks of the Mount Observation Range and at right angles to the range. Instead of going through this ridge of hard rock into the soft country beyond, it turns due south again and pursues a very tortuous course down the centre of the ridge, until, nearing Mount Observation at the southern end of the ridge, it becomes directed to the south-east and flows past Queen's Own Town into the

delta of the Murray. The river, through most of its course, and especially in its passage through the hard Cambrian slates, has the characteristics of an incised meander. Its present channel must have been determined at a time when the valley floor was at an even level with the upper limits of the old rocks which now form the Mount Observation Range.

Giles Creek takes its rise in the northern portions of the present glacial basin, and follows the eastern limits of that basin, just as the River Finniss, in the first half of its course, follows the western limits of the same. The River Finniss represents the western and southern, and Giles Creek the northern and eastern, portions of the basin In both cases the respective tributaries of the streams are gathered from the older rocks which form a rim of highland around the glacial basins.

The same strongly differentiated botanical features seen in the Mount Compass district, between the Cambrian and glacial areas, are equally marked in the district now under consideration. The prominent ridges of old rocks carry big timber or are cultivated, whilst the glacial areas, represented by the River Finniss Valley, and more particularly by the sandy ridge between Mount Observation and Giles Creek, are covered by a dense and dwarf scrub characteristic of the glacial country. The latter improves greatly in quality where, bordering on the outcrops of the older rocks, it receives contributions of stronger soil washed down from the adjacent hills.

Glacial.—My attention was called by Mr. Jas. Stone, of Bull's Creek (who had recognized the presence of granite boulders in the clay), to a road-cutting in glacial till in the northern parts of this basin. The cutting is situated on the Strathalbyn and Bull's Creek Road, about four and a half miles from Strathalbyn, a little west of Gemmell's Hill, and within the valley of Giles Creek (Section 1823, Hundred Kondoparinga), (plate xxxix.). The section is about 80 yds. long and 10 ft. in greatest height. Numerous erratics occur in the clay, and others which were thrown out at the time of making the cutting are lying on the top of the bank. More than twenty erratics of granite, of various types, were counted within the distance occupied by the cutting, several having a diameter from 1 to 2 ft., and one that had been removed to the side of the road measured 4 ft. in length, 2 ft. in width, and 1 ft. 9 in. in height. A goodly number of schistose rocks ("bluestone") that are commonly met with in the till at Hallett's Cove and the Inman Valley, and which frequently show glacial marks, were noted among the erratics

and carried glacial striæ (plate xl.). Some of the granites and a piece of gneiss also showed glacial abrasions.

The surrounding country is covered with a light, white-coloured, sandy soil, underlain by a whitish stiff clay of glacial origin. Sections of these beds can be seen in most of the creeks of the neighbourhood. At Giles Flat, about a mile west of the road-cutting just described, Giles Creek crosses the main road, and was followed for some distance on the south side of the road, where the exposures of the glacial beds showed at the water-level a very tenacious white, blue, and pinkish clay, which, when dry, has a characteristic concave fracture. Resting on this clay are soft, gritty sandstones, covered with recent stream-wash. The beds in the creek, so far as they came under my observation, contain but few boulders.

Going further west, on the same road, small erratics (up to 1 ft. in length) occur by the roadside. Just before reaching the Bull's Creek Ranges the main road descends to the level of Bull's Creek at the point where it emerges from the ranges and receives the waters of Baulderstone Creek. A district road branches off from the main road on the north side and goes up the Baulderstone Creek Valley. At the junction of the two roads a small washout in glacial clay with erratics occurs. Following the district road for about three-quarters of a mile, a number of small erratics were found on Mr. Jas. Stone's ground (Sections 1837 and 1839), consisting of granites, porphyry, and quartzite, the greater number occurring on a low sandy ridge in Section 1837; one erratic showing a highly-polished facet The range of hills through which Bull's Creek has cut its gorge appears to be the limits of the glacial deposits on the north-western side of the basin.

South of the junction of Baulderstone Creek with Bull's Creek the latter flows outside of the range, on its eastern side, until it unites with the River Finniss, about a mile south of Ashbourne. The country on the eastern side of the range is comparatively low, and is characteristically glacial-sand country. The Ashbourne flats are included in the same class of country with the line of division (separating the glacial beds from the Cambrian) running along the base of the hills on the western side of the Victor Harbour main road. At the Finniss Bridge near Ashbourne, and in the river-bed to the south, the stream has cut down into the glacial sandstones and clays, making deep ruts, potholes, and fantastic carvings at various places.

The physiographical features of Mount Observation (forming a great inlier of old rocks in the glacial beds) have

already been described. At about three-quarters of a mile east of the Finniss Bridge, a sharp line of distinction is apparent where the glacial sands and clays abut against these old slates of Mount Observation. Quarries have been worked in the glacial clays and grits for road-making. The clays are dense, whitish, and often penetrated by strings of sandy material irregularly distributed through it. Numerous rounded pebbles, some of which proved to be granitic or other stones foreign to the neighbourhood, occur in the area.

The main road going south from the Finniss Bridge shows many exposures of the glacial beds in road-cuttings. The beds carry numerous stones lying at all angles to each other, while the bedding is very mixed and tumultuous in its arrangement, often showing vertical or strongly-contorted layers.

The road continues to follow the glacial valley which widens out in its southerly extension, passing from the Hundred of Kondoparinga to the Hundred of Nangkita. Wide flats extend between the road and the River Finniss on the western side, and low scrubby hills of glacial sandstone occupy the eastern side of the road. Near the boundary of the two Hundreds the stone has been worked for making the roads. The glacial grits are here very hard, and take the form of cemented conglomerates outcropping near the summit of the ridge. There has been a considerable shed of broken material and gravel down the steep slopes of the hill, and the road metal has been largely gathered from this source. The depth of the respective workings does not exceed 2 ft. On the extreme summit of the ridge the old slate rocks are exposed.

In several of the cuttings on the road, granite and other erratics were noted, but the granitic examples were all greatly decomposed. Resting on the undisturbed glacial beds newer deposits of sands and gravels are frequently seen. Whilst the material in these recent beds has been largely gathered from the local glacial deposits, they can be easily distinguished from the same. The newer beds are less indurated than the glacial, and have been laid down by stream action, and are more regularly distributed and stratified. They mark the old river-levels during the excavation of the present valley of the Finniss.

As the South Road passes into the Hundred of Nangkita there is a great widening out of the old glacial area, the characteristic swamp country is met with, and the great glacially-formed Nangkita basin, already described, is within view.

The lower Finniss, or that part of the river-course measured from the point where the stream emerges from the Mount Observation Gorge, and thence, eastward, to the railway line, possesses some interesting features. In this section of its course the river forms the dividing line between the Hundreds of Kondoparinga and Nangkita, and flows between banks of glacial sandstone and clays throughout its entire length. Excellent sections of the beds can be seen in the river cliffs at various points.

About three miles up from the railway, in a straight line, on the right bank of the stream (Section 2021, Kondoparinga), there is a vertical wall of white glacial sandstone, 20 ft. high, resting on a Cambrian floor and covered with recent high-level river gravels. The sandstone contains pockets and wedges of gravelly material, resting at all angles, in the finer matrix (plate xli.)

A short distance higher up the stream, on the left bank (Section 2329, Nangkita), is another striking outcrop. Here the beds consist of a very strong, compact conglomerate of rounded stones, including varieties of quartz, quartzite, schists, and numerous granites, the latter mostly decomposed. The arrangement of the stones, in relation to their size, is very irregular. Within the conglomerate is a large granite boulder, porphyritic in structure, and measuring 4 ft. 6 in. by 3 ft. The cement of the conglomerate is siliceous and sometimes ferruginous. Near the middle of the section is a band of finer material, about a foot in thickness, with concretionary ironstone nodules or "iron-boxes." Resting on the top of the conglomerate is a sandstone bed much contorted in the grain, a common feature of the glacial sandstones of the district. The beds show a dip of 15° in the direction of the valley slope (plate xlii.).

In descending the river, from the outcrops just described, the beds become more uniform in texture, fine-grained (occasionally with coarser fragments), white to brown in colour, and very variable as to cohesion. The grain of the stone, brought out by weathering, exhibits some remarkable features. Whilst massive to the extent of many feet in thickness, the grain of the stone is curiously twisted, curled, and contorted. These contortions are not of the nature of colour lines, such as often develop by chemical change in some slates and argillaceous sandstones, but original lines of deposition. Neither can these discordant lines of deposition be referred, in all cases, to current bedding, as they are too confused and irregular. They seem to give clear evidence of contemporaneous contortion produced by the ploughing movement of ice-masses (plate xliii.).

The glacial origin of these sandstones is still further borne out by the microscopical structure of the stone (plate xlv.). In some cases, as in the main quarry (Collett's) of the lower Finniss, the fragmental constituents are almost entirely angular and often mere splinters; whilst in other instances, as the Yankalilla sandstone, for example, there are rounded grains intermixed with the angular. There is a complete absence of interstitial cement, as ordinarily present in fragmental rocks, and the stone has been made to cohere by the interlocking of its angular particles and an infilling of very finely triturated grains of the same mineral substance as the larger fragments. This fine pasty material was probably of the nature of the "rock flour," which is characteristic of glacial erosion, and which under the effects of very great pressure has proved the cementing agent of the stone in question. The material composing the sandstones is almost exclusively quartz, but as casual constituents, some felspars, aluminium silicates, and iron oxides have been observed in the sections made.

The sandstone, as developed in the neighbourhood of the lower Finniss, makes a fairly good building stone, and has been extensively used for this purpose. Several quarries have been worked on either side of the river above the railway bridge. The chief quarry now in operation is on Mr. Collett's land, in Section 173, Nangkita, situated a little above the district road bridge over the River Finniss. The quarry face is about 30 ft. in height (plate xliii.), showing strong stone to within a few feet of the top. The upper portion, as shown in the photograph, is a softer stone, which, in weathering, has brought into relief strongly-contorted bedding lines. The main stone in the quarry exhibits no bedding planes, but there are close joints which intersect the stone at high angles, and, in places, are iron-stained. No quartz-veins occur, and the rock resembles, in all respects, sandstones of the same age and origin as developed at Yankalilla, Myponga, and other places. As a building stone it was used in the construction of the railway bridge across the River Finniss and many other local structures, the railway station buildings at Strathalbyn, the Bank of New South Wales in Adelaide, and the stone pillars at the entrance gates of the Adelaide University (plate xliv.). Its defect as a building stone is in its unequal hardness and tendency to weather on exposure. Some of the masses of rock that formed the outcrops of the bed were avoided by the workmen as too hard for dressing, while, on the other hand, in the case of some samples used in architecture, after thirty years of exposure, they show a marked deterioration. When rebuilding the pillars and coping-stones at the University

grounds, recently, many of these Finniss stones had to be replaced, on account of this excessive weathering.

The same sandstone can be studied outside the immediate valley of the Finniss. In the banks of Giles Creek (Section 2033, Kondoparinga) an outcrop can be recognized from the public road showing strong features. A little to the north of the last locality, at the bend of the road, and also at points higher up Giles Creek, the stone has been quarried for road metal. At the south end of Mount Observation, on the north side of the Black Swamp Road (Section 167, Nangkita), another quarry has been worked. The stone for building the culvert on the south side of Gilberts railway station was got from the banks of the stream spanned by the bridge, and the old quarry is now utilized as a waterhole (Section 173, Nangkita).

A bore put down on Mr. A. E. Henley's land, in the south-westerly corner of Section 2057 (Kondoparinga), and situated about a mile north of Queen's Own Town, within the limits of the glacial area, penetrated sand, sandstone, and blue clay, in which latter the bore was discontinued at a depth of 175 ft.

Undisturbed glacial deposits could not be definitely determined on the eastern side of the railway line. As the River Finniss nears its estuary in the labyrinth of waters of the lower River Murray, the glacial beds give place to more recent deposits which are evidently, in many instances, built up by the waste and redeposition of the material gathered from the vast glacial basins drained by the river and its tributaries. Thick deposits of river gravel occur both above and below the railway bridge, as well as in the cuttings on the railway.

Older Tertiary Outlier.—A remarkable and very restricted outlier of glauconitic clay, of Lower Tertiary age, occurs in the river-bed under the railway bridge that spans the Finniss, and in which the foundations of the bridge have been laid. The bed is highly fossiliferous, and can be detected for only a short distance, and for the most part below the water-level. The rock is such as occurs in the older Tertiaries of Gulf St. Vincent and some portions of the Murray Flats, but its occurrence at the Finniss was quite unsuspected until pointed out to me by Mr. Henley. It is not known in any other part of the district, nor has it been met with in the well-sinkings of the neighbourhood. It appears to be a small patch, resting unconformably on the glacial beds, and an outlier of the older Tertiary of the Murray Plains.

DESCRIPTION OF PLATES.

Plate XXXI.

Geological sketch-map of the glacial beds as preserved in the ancient Permo-Carboniferous glacial basins of Mount Compass, Nangkita, Giles Creek, and River Finniss.

Plate XXXII.

Sandy flat of disintegrating glacial sandstones between Mount Compass and the Willunga Ranges, which are seen in the distance. The view includes the almost level watershed of the Finniss River, which flows to the east, and the Myponga River, which flows to the west.

Plate XXXIII.

View of Mount Compass glacial basin, as seen looking south. A portion of Mount Moon appears on the left hand. Mount Compass township in the centre, and hills of glacial sandstone in the distance.

Plate XXXIV.

End view of Mount Moon, showing abrupt termination of the hill on the west, with "wind-gap" in the foreground.

Plate XXXV.

General view of Mount Compass glacial basin from Wood Cone, looking north, with Mounts Compass, Moon, and Effie in the middle distance. These hills form rounded inliers of Pre-Cambrian rocks surrounded by glacial sandstones and clays, with swamps in the lower levels.

Plate XXXVI.

Glacial standstones on the west side of Mount Compass, forming the watershed between the east and west drainages, and the dividing line between the Hundreds of Nangkita and Myponga.

Plate XXXVII.

Cleland's Gully Range, near Mount Compass, composed of glacial sandstones, etc., as seen from the main road on the south side.

Plate XXXVIII.

Quarry in glacial sandstone with erratics, situated on the main road, a little south of the Square Waterhole, and near the southern boundary of the Hundred of Nangkita. A glaciated erratic from this quarry is reproduced by photograph on Plate xl.

Plate XXXIX.

Two views of glacial till, exposed in a road-cutting west of Strathalbyn.

Plate XL.

Upper figure.—An erratic of black quartz showing glacial polish, facets, and striæ. Obtained *in situ* in the quarry near the Square Waterhole, figured in Plate xxxviii. Half natural size.

Lower figure.—Glaciated erratic of fine-grained schist, found *in situ* in road-cutting of glacial till west of Strathalbyn. (See Plate xxxix.) The stone is faceted at diverse angles, and strongly scored with striæ. Two-thirds natural size.

Plate XLI.

Glacial sandstone, with irregular pockets of boulders, forming a cliff in the bed of the River Finniss, 3 miles above the railway bridge.

Plate XLII.

Another river-cliff, near the one figured in Plate xli., composed mostly of boulders, one of which (a granite boulder) measures 4 ft. 6 in. by 3 ft. Overlying the boulder-bed is a glacial sandstone showing contorted lines of bedding.

Plate XLIII.

Quarry in glacial sandstone, situated in the banks of the River Finniss above the railway bridge. The upper portions of the quarry face show strongly-curved bedding planes, and the more compact stone develops similar evidences of contemporary distortion when weathered. (See Plate xliv.)

Plate XLIV.

Photographic reproduction of the Finniss River sandstone, as exposed in the stone pillars at the entrance to the Adelaide University grounds. The stone had been smoothly worked, but as the result of weathering the original grain has been brought into relief, and displays broken and crumpled planes of deposition.

Plate XLV.

Two microscopic sections of the Finniss River sandstone, showing the sharp and angular forms of the grains. The finer material is of the same kind, and has the features of a glacial "rock-flour." Magnified 18 diameters.

Note on a New Linguatula.

By E. A. Johnson, M.D., M.R.C.S.

[Read September 6, 1910.]

Plate XLVI.

Linguatula dingophila, n. sp.

In 1904 I made a post-mortem on a pure country dingo, in order to see if the *Tænia echinococcus* was present. However, in this I was disappointed, but found a *Linguatula* in the nasal cavities.

This on the most cursory examination was, in my opinion, new to science, and on searching all available literature has justified my describing it as such, and accordingly naming it.

The *Linguatula rhinaria*, first described by Pilger, 1802, is a parasite which. under various names, is an inhabitant of the nasal cavities occasionally of the dog.

It is a parasite very rarely met with, even by the keen hælminthologist, and never, unless by accident, does the general medical practitioner see it. I have not seen it in a museum.

In the larval stage, *e.g.*, as *Pentastoma denticulatum*, one meets it in lands where uncooked meat is eaten, as in Germany.

One sees it encysted in the liver; usually one or two specimens are present. It occurs far more rarely in the spleen, kidney, or intestinal wall.

Tenker found it in 9 out of 168 autopsies.

Frerichs (Breslau), 5 out of 47 autopsies.

In Switzerland it is much rarer. Klebs saw only one case in 900 autopsies.

In Kronstadt (Russia), 6 cases in 659 autopsies.

Given an infected dog, the means by which the *Linguatula* is spread are as follows:—

The ova (already containing an embryo) are expelled with the nasal secretion in great numbers. Those which fall on grass are swallowed by the various herbivora in their food, *viz.*, usually rabbits and hares; less commonly sheep,

oxen, horses, goats, antelopes and fallow deer, pigs and cats; very rarely human beings.

After being hatched in the stomach the larvæ bore through the intestinal wall to the liver, where they become encysted. Several moultings take place, and the second larval stage sets in; then they take on the adult form. Five to six months after ingestion the *Linguatula* are 4-6 mm. long, the mouth and intestine are formed, and the sexual organs mature.

This larval stage has been known for a very long time, and as the parasite was regarded as a new one, the name *Pentastoma denticulatum* was given. These larvæ then become very active and escape into the open by means either of the intestine or bronchi, to complete their cycle by being again sniffed up into the nose of a dog, wolf, or fox, occasionally horse and goat, where, after being stationary for a short time, another moulting takes place, and in six weeks' time the parasites become adults.

The *Linguatula* found in the dingo differs in many respects from its relation in the dog. In tabular form this at once becomes apparent:—

Linguatula rhinaria. (Dog.)	*Linguatula dingophila.*
Male.—White. 18-20 mm. long. Anterior portion, 3-4 mm. broad. Posterior portion, 0·5 mm. broad.	*Male.*—Not discovered.
Female.—Yellowish. 8-13 cm. long	*Female.*—Yellow, with brown egg ridge. 2 mm. high. 3 cm. 1 mm. long.
Anterior portion, 8-10 mm. wide. Posterior portion, 2 mm. wide.	Anterior portion, 12 mm. wide. Posterior portion, 2 mm. wide.
The brownish eggs are seen in median line.	The surface on which the egg-ridge is placed is curved on the flat, and so if a transverse section were made, since the other surface is quite flat it would appear D-shaped.
Body.—Elongated, rather flat, shows 90 rings or segments, with crenellated borders, anterior end rounded.	
Hooks.—Round, mouth strongly curved, and are articulated to a basilar support.	The anterior end comes to a rough point; as the parasite is so thick and very deep in colour (preserved in Kaiserling) it is impossible to determine the mouth or hooks.
Eggs.—Oval, ·09 mm. long ·07 broad.	*Eggs.*—More round than oval, ·05 mm. long × ·025 wide.

DESCRIPTION OF PLATE XLVI.

Linguatula dingophila.

This plate is enlarged 6 times the size of the parasite, thus affording a much better idea of what is to be seen.

Both ends are pointed, the anterior portion being broad, and gradually decreasing in size till the posterior end is reached.

The egg-ridge is the darkly-stained centre; this, also, is broad at the commencement, and tapers to a point. It extends three-fourths of the total length.

The segments or rings are well defined.

ABSTRACT OF PROCEEDINGS

OF THE

Royal Society of South Australia

(Incorporated)

FOR 1909-10.

ORDINARY MEETING, NOVEMBER 2, 1909.

THE PRESIDENT (J. C. Verco, M.D., F.R.C.S.) in the chair.

EXHIBITS.—Mr. E. ASHBY exhibited birds from Lake Frome, *viz.*, *Stiltia Isabella*, *Artamus personatus*, *Psephotus xanthorrhous*, also a possibly new *Acanthiza;* from the River Murray, above Mannum, *Epthianura tricolor* (Gld.), a rare Southern visitor, and its nest and eggs; *Myzomela nigra*, with nest and eggs; also a long series of birds from North-Eastern Tasmania. Mr. ASHBY also exhibited samples of tin ore, occurring in rocks, probably of Silurian age, in Tasmania, and supplied the following notes in relation to the same:—"We believe the discovery of the occurrence of tin in Silurian rocks is very rare, or possibly unique, and is, therefore, of considerable scientific interest. The mine known as the Great Pyramid is situated about six miles from Scamander, on the north-east coast of Tasmania. The rocks are described as Silurian in the Government geological maps. As far as we are aware, the nearest granite would be some miles away. The tin occurs in quartzite beds, in a steep anticline of folded slates and quartzites. The hill is about 500 ft. high above the River Scamander. On the north side the superincumbent beds have been denuded, and a bed of quartzite has been exposed which, where penetrated by the north adit, is 30 ft. thick. This quartzite bed has been broken into and sampled on the north side over a longitudinal length of 1,000 ft. and a vertical width of 100 ft. by means of deep trenches blasted out of the solid rock. Something of the probable commercial importance of the discovery may be inferred from the fact that the average result of this sampling shows the metallic tin contents of this quartzite bed to be fully 1 per cent. On the south side of the hill, several of the beds on folds that have been eroded from the northern side still exist on the bulging portion of the hill. While the beds, or folds, of slate

(mudstone) only carry a trace of tin, the folds of quartzite have a very fair percentage: one bed, 20 ft. thick, averages over 1 per cent. of metallic tin, and is possibly the other leg of the fold exposed on the northern side. The tin occurs in narrow, sometimes hair-like, seams, running at right angles to the strike of the folds, *i.e.*, across the hill, and not along it. From careful examination it seems evident that the tin was deposited as alluvial tin, probably under sea or lake. The occurrence on the south side of portions of several tin-bearing folds, together with the width over which this deposit occurs, indicates that the deposition was continued over a very considerable period on an extensive scale. The folding, together with metamorphic action that has taken place since its deposition, may have led to some alteration in the position in which the tin occurs in the beds; to determine this a careful microscopical examination would be necessary. That tin-bearing rocks were exposed and subject to extensive erosion during, or prior to the Silurian age, is clearly evidenced by this discovery, and should be of considerable interest to geologists as well as mineralogists."

Ordinary Meeting, April 5, 1910.

The President (J. C. Verco, M.D., F.R.C.S.) in the chair.

Exhibits.—Mr. J. G. O. Tepper exhibited the larva of a Queensland hawk-moth, *Sequosa triangularis*, and made some observations on hawk-moths: also, galls of a species of thrips, from the north-western district, on *Acacia*. The galls contain 60 to 100 larvæ each. Galls on *Acacia aneura* at Broken Hill are so numerous that they bear the trees down. Mr. Edquist exhibited *Cuscuta epithyma*, the dodder, found growing on red clover at the High School, from which it has spread to, and attacked, a native species of saltbush; also, an estuarine bivalve mollusc, which was quite active after eight days without water and exposed alternately in the sun and shade. The specimens exhibited opened at once on being placed in sea water. Dr. Pulleine exhibited spiders —*Nephila*, to show enormous disproportion between male and female; *Argyrodes commensal*, in the webs of *Nephila* (from Sydney): *Seleno cosmia*, a gigantic earth-spider from Pichi Richi Pass. Dr. Sweetapple exhibited a section of a chalcedonized tree-trunk from the United States of America. Mr. Howchin exhibited a group of *Archæocyathinæ* from Wilson, South Australia; and, as Editor, announced the completion of part ii., vol. ii., of the Memoirs of the Society, on *Archæocyathinæ* from the Cambrian of South Australia, by T. Griffith Taylor, B.Sc., B.A., etc.

Paper.—"The Glacial Moraines of Permo-Carboniferous Age of Rosetta Head and King's Point," by Walter Howchin, F.G.S. Mr. Mayo recorded that his measurement of the present height of Rosetta Head shows it to be 325 ft.

Ordinary Meeting, May 3, 1910.

The President (J. C. Verco, M.D., F.R.C.S.) in the chair.

Visitors.—C. Hedley, F.L.S., Sydney, and R. H. Relton, Brisbane.

Exhibits.—Mr. W. Howchin, F.G.S., exhibited a specimen of Lower Tertiary fossiliferous glauconitic clay, from the railway bridge, Finniss River. He stated that this was a new locality for rocks of this age and type, the nearest occurrences to it being the shores of Gulf St. Vincent, the Torrens Valley near Adelaide, and the Murray Flats. Mr. Edquist exhibited a block of firewood bored by the larvæ of *Phoracantha recurva*, a longicorn beetle, showing the capsules formed when pupating. Parasitic hymenopterous cocoons were also present in the borings. Dr. Pulleine exhibited specimens showing sexual dimorphism in spiders of the genera *Cælenia*, *Eriodon*, and *Nephila*. Mr. H. G. Griffith exhibited specimens showing sexual dimorphism in insects.

Papers.—"Two New South Australian Nephilæ," by H. R. Hogg, M.A., F.Z.S., communicated by Prof. Stirling, M.D., F.R.S.; "Brachipods of South Australia," by J. C. Verco, M.D., F.R.C.S., with exhibits of specimens and diagrams. Mr. Hedley, F.L.S., remarked:—"That owing to the wide distribution of Brachiopods they are a difficult group for a local malacologist to study; also, a difficulty is presented by each species in its growth repeating its genealogical history, so that the same species in different stages of development may be referred to different species or genera."

Ordinary Meeting, June 7, 1910.

The President (J. C. Verco, M.D., F.R.C.S.) in the chair.

Nominations.—Prof. Kerr Grant, M.Sc., University of Adelaide; Mr. E. V. Clark, B.Sc., University of Adelaide; Dr. E. A. Johnson, Franklin Street; Mr. E. R. Stanley, University of Adelaide.

Exhibits.—Mr. S. Dixon exhibited a specimen of Amblydonite, from Bulla Bulling, W.A., a rare mineral, which occurred in granitic country. Dr. Pulleine exhibited a trapdoor spider, of the genus *Dyarcyops*, and its nest, which pos-

sessed a peculiar closing mechanism half-way down the tube. Mr. TEPPER showed photographs of the sun taken during the recent eclipse; also, a wood-boring buprestid larva, infesting mallee roots; also, a brenthid-like insect, described by Lea, which lives in symbiosis with *Lobopelta excisa*, a Queensland ant; also, Carabidæ, from Mount Gambier.

PAPER.—"Descriptions of Australian Curculionidæ, Part VIII.," by A. M. LEA, F.E.S.

LECTURE.—The meeting then adjourned to the lecture-room, and as the public were admitted there was an audience of 150 when Dr. PULLEINE gave a lantern lecture on "The Trap-door and Hunting Spiders of South Australia."

ORDINARY MEETING, JULY 5, 1910.

THE PRESIDENT (J. C. Verco, M.D., F.R.C.S.) in the chair.

ELECTIONS.—Prof. Kerr Grant, M.Sc., E. A. Johnson, M.D., M.R.C.S., E. V. Clark, B.Sc., and E. R. Stanley were elected Fellows.

EXHIBITS.—Mr. E. ASHBY exhibited birds from South, North, and East Australia and Tasmania, including parrots, pittas, flycatchers, and honey-eaters. Dr. PULLEINE exhibited the male of *Cœlema excavata*, being the first recorded male of any species of the purely Australian genus *Cœlema*.

PAPER.—"Description of a New and Extensive Area of Permo-Carboniferous Glacial Deposits in South Australia," by WALTER HOWCHIN, F.G.S.

ORDINARY MEETING, AUGUST 2, 1910.

THE PRESIDENT (J. C. Verco, M.D., F.R.C.S.) in the chair.

EXHIBITS.—Mr. J. G. O. TEPPER exhibited pupa cases of *Julodimorpha Bakewelli*, a buprestid beetle, which had been found 3 ft. below the surface at Beri Beri, on the Murray River. Dr. VERCO and Mr. ASHBY also reported having obtained the same insect from the southern coast of Eyre Peninsula. Mr. E. ASHBY exhibited a specimen of the pouched mouse, *Sminthopsis crassicaudatus*, from Orroroo.

PAPERS.—"On a New Species of Boronia," by J. H. MAIDEN, F.L.S., and J. M. BLACK; "Additions to the Flora of South Australia, including sixteen alien and five Australian Species," by J. M. BLACK; "On the Enstatite Basalt occurring at Kangaroo Island," by E. R. STANLEY; "A Complete Analysis of Lherzolite and Olivine found at Mount Gambier," by E. R. STANLEY. THE PRESIDENT complimented the new Fellow on the excellence of his papers.

Ordinary Meeting, September 6, 1910.

The President (J. C. Verco, M.D., F.R.C.S.) in the chair.

Exhibits.—J. G. O. Tepper, F.L.S., exhibited butterflies and beetles collected in Paraguay by Mr. Weidenhofer. Mr. Baker exhibited *Scyllarus sculptus*, a peculiar crustacean from New South Wales; also, several isopod crustaceans. Dr. E. A. Johnson exhibited *Linguatula rhinaria*, a parasitic worm from the frontal sinus of the dog, and also its larval stage, *Pentastomum denticula*, from man; also, a *Linguatula* from the *Canis dingo*.

Papers.—"Notes on some Species of the Isopod Family, *Sphæromidæ*, from the South Australian Coast," by W. H. Baker. This paper embodied descriptions of seven new species of this family of marine scavengers, which show extreme sexual dimorphism and developmental variation. "Notes on a new *Linguatula* from the Frontal Sinus of the *Canis dingo*," by Dr. E. A. Johnson.

The Annual Meeting, October 4, 1910.

The President (J. C. Verco, M.D., F.R.C.S.) in the chair.

The annual report and balance-sheet were read and adopted.

Election of Officers.—*President*, Dr. J. C. Verco, M.D., F.R.C.S.; *Vice-Presidents*, Prof. Rennie, D.Sc., M.A., and W. Rutt, C.E.; *Treasurer*, W. B. Poole; *Members of Council*, R. S. Rogers, M.A., M D., and S. Dixon; *Auditors*, W. L. Ware and J. S Lloyd, F.I.A.S.A. The Council was accorded a vote of thanks for the work of the past year.

Exhibits.—Dr. E. A. Johnson, a white mouse with large cancerous growth inoculated by Prof. Jensen, of Copenhagen. Dr. Mawson showed a specimen of the first occurrence of pitchblende in Australia. This was an absolutely pure oxide of uranium, produced by the secondary deposition of an uranium-bearing mineral. The specimen came from Radium Hill, Olary, S.A. Mr. W. H. Selway exhibited *Homeria collina* from Green Hill, an introduced plant hurtful to cattle. Dr. Verco introduced Mr. Rainbow, F.L.S., as the entomologist of the Australian Museum, Sydney, who was visiting Adelaide for scientific purposes. Mr. Rainbow drew attention to the name *Macropus*, which, though given to a beetle, was preoccupied by a marsupial.

Papers.—"Notes on Australian Coleoptera, No. XL.," by Canon Blackburn, B.A.; "Notes on Marine Mollusca of South Australia, Part XIII.," by J. C. Verco, M.D.,

F.R C S.; "Hæmatozoa of Australian Birds, Part I.," by J. B Cleland, M.D C.M., and H. Johnston, M A., B.Sc.

ANNUAL REPORT, 1909-10.

The Council has pleasure in reporting that the work of the Society has been carried on successfully during the past year.

Mr. W. Howchin, F.G.S, was re-elected to represent the Society on the Board of Governors of the Public Library, etc.

Library.—Owing to the long illness and subsequent death of Mr. Idle, the work of arranging and classifying the library has been much interfered with. At the request of the Council Mr. Clucas, the University Librarian, furnished a valuable report, and the services of his assistant having been secured, the arrangement and classification are now proceeding satisfactorily. To aid in the collation of publications for binding, a large number of pamphlet cases have been purchased

In consequence of Mr. Idle's decease and other circumstances, the binding of publications has been in abeyance, but arrangements are now being made to have it proceeded with. An index catalogue of publications is now being compiled under the direction of Mr. Clucas.

Four new Fellows have been elected during the year:—Prof. Kerr Grant, M.Sc., Professor of Physics in the Adelaide University; Mr. E. V. Clark, B.Sc., Lecturer on Electrical Engineering at the Adelaide University; Mr. E. R. Stanley; and Mr. E. Angas Johnson, M.D., M.R.C.S The last two have already contributed papers.

Obituary.—Mr H. S. Munton, a Fellow since 1884.

Membership.—Honorary Fellows, 8; Corresponding Members, 6; Fellows, 63; Associate, 1.

Jos. C. Verco, *President.*
R. H. Pulleine, *Secretary.*

ROYAL SOCIETY OF SOUTH AUSTRALIA (INCORPORATED).

Revenue and Expenditure for 1909-10.

Dr.	£	s.	d.	£	s.	d.
To Balance, Oct. 1, 1909				525	4	8
,, Subscriptions—						
Royal Society	79	5	0			
Field Naturalists' Section ..	19	17	6			
Malacological Section	2	5	0			
Microscopical Section	11	7	6			
				112	15	0
,, Grants from Government—						
On Subscriptions	72	18	0			
For Printing Reports on Scientific Investigations in South Australia	150	0	0			
				222	18	0
,, Sale of Transactions .. .				1	7	2
,, Interest—						
On S.A. Government Stock (Endowment Fund) ...	75	0	0			
Savings Bank	8	2	6			
Discount on an account paid	0	2	6			
				83	5	0
				£945	9	10

Cr.	£	s.	d.	£	s.	d.
By Transactions—						
Printing	99	0	9			
Illustrating	106	12	4			
Publishing	9	12	8			
				215	5	9
,, Memoirs—						
Printing	111	19	6			
Illustrating	0	16	3			
Publishing	9	16	8			
				122	12	5
,, Grants—						
Field Naturalists' Section ..	15	0	0			
Malacological Section .	1	0	0			
Microscopical Section . ..	12	10	0			
				28	10	0
,, Library—						
Pamphlet Cases	4	19	0			
Carriage of Books ..	0	13	0			
Cataloguing	13	13	3			
				19	5	3
,, Caretaking and Lighting ...	12	9	8			
,, Printing, Stationery, and Postage	9	4	9			
,, Advertising	2	9	5			
,, Bank Account Charge ...	0	10	0			
				24	13	10
,, Balance, Sept. 30, 1910 ...				535	2	7
				£945	9	10

Examined and found correct—

Howard Whitbread, } Auditors.
W. L. Ware, }

September 30, 1910.

W. B. Poole, Treasurer.

ENDOWMENT FUND.

Dr.	£	s.	d.		£	s.	d.
To Amount of Fund	2,006	0	0	By £2,000, S.A. $3\frac{3}{4}$ per cent. Inscribed Stock	1,997	10	0
				,, Balance in possession of Treasurer	8	10	0
	£2,006	0	0		£2,006	0	0

Examined and found correct—
HOWARD WHITBREAD, W. L. WARE, } Auditors.
September 30, 1910.

W. B. POOLE, Treasurer.

SUMMARY OF BALANCES.

	£	s.	d.		£	s.	d.
Revenue and Expenditure Account	535	2	7	In Bank of Australasia	268	14	2
Endowment Fund	8	10	0	In Savings Bank	273	17	5
				In Treasurer's Hands	1	1	0
	£543	12	7		£543	12	7

Examined and found correct—
HOWARD WHITBREAD W. L. WARE. } Auditors.
September 30. 1910.

W. B. POOLE. Treasurer.

DONATIONS TO THE LIBRARY

FOR THE YEAR 1909-10.

TRANSACTIONS, JOURNALS, REPORTS, ETC.,

presented by the respective Editors, Societies, and Governments.

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AUSTRALASIAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE *Solar Physics Committee.* Memorandum upon the proposed solar observatory in Australia. Adel. 1909.

AUSTRALASIAN INSTITUTE OF MINING ENGINEERS. Transactions, vol. 13. Melb. 1909.

AUSTRALASIAN MEDICAL CONGRESS. Eighth session. 3 vols. Melb. 1908.

AUSTRALIA.

AUSTRALIA. *Bureau of Census and Statistics.* Official year book, no. 3, 1901-09. Melb. 1910.

AUSTRALIA. *Bureau of Meteorology.* Bulletin, 3-5.

——— ——— Maps: average rainfall map of New South Wales, 1910.

——— ——— Monthly report, vol. 1, no. 1. 1910.

——— ——— Rainfall map for 1909.

ROYAL ANTHROPOLOGICAL SOCIETY OF AUSTRALIA. Journal: Science of man, vol. 11, no. 7-12; vol. 12, no. 1-4. Syd. 1909-10.

NEW SOUTH WALES.

AGRICULTURAL GAZETTE OF NEW SOUTH WALES, vol. 20, pt. 9-12 and index; vol. 21, pt. 1-9.

AUSTRALIAN MUSEUM. Memoir 4, pt. 12. Syd. 1910.

——— Records, vol. 7, pt. 4-5. Syd. 1909-10.

——— Report of the trustees, to June 1909. Syd.

——— Special catalogue, vol. 2, pt. 3. Syd.

LINNEAN SOCIETY OF NEW SOUTH WALES. Abstract of proceedings, no. 281-282. Syd. 1910.

——— Proceedings, vol. 34, pt. 2-4; vol. 35, pt. 1-2. Syd. 1909-10.

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MAIDEN, J. H. Forest flora of New South Wales, vol. 4, pt. 6-9. Syd. 1909-10.

NEW SOUTH WALES. *Board of Fisheries.* Report on the fisheries of New South Wales for 1908. Syd. 1909.

NEW SOUTH WALES. *Botanical Gardens and Government Domains.* Report of the director, 1908. Syd. 1909.

NEW SOUTH WALES. *Department of Mines.* Annual report, 1909. Syd. 1910.

——— ——— Memoirs of the Geological Survey: palæontology, no. 5; vol. 5, pt. 2. Syd. 1910.

——— ——— Records of the Geological Survey, vol. 9, no. 1. Syd. 1909.

NEW SOUTH WALES NATURALISTS' CLUB. Journal: The Australian naturalist, vol. 1, pt. 16; vol. 2, pt. 1-3. Syd. 1909-10.

PUBLIC LIBRARY OF NEW SOUTH WALES. Report, 1908, 1909. Syd. 1909-10.

SYDNEY UNIVERSITY. Calendar, 1910. Syd. 1910.

QUEENSLAND.

QUEENSLAND. *Department of Mines.* Geological Survey publications, no. 223-5, 228-9. Brisb. 1909-10.

SOUTH AUSTRALIA.

PUBLIC LIBRARY, MUSEUM, AND ART GALLERY OF SOUTH AUSTRALIA. Report of the Board of Governors, 1908-9. Adel. 1909.

SOUTH AUSTRALIA. *Department of Intelligence.* Bulletin, no. 8. Adel. 1909.

SOUTH AUSTRALIA. *Department of Mines.* Review of mining operations, no. 10-11. Adel. 1909-10.

SOUTH AUSTRALIA. *Northern Territory.* Government Geologist's report on the Tanami gold country. Adel. 1909.

SOUTH AUSTRALIA. *Woods and Forests Department.* Annual progress report, 1908-9. Adel. 1909.

TASMANIA.

ROYAL SOCIETY OF TASMANIA. Papers and proceedings, 1909. Hobart.

TASMANIA. *Department of Mines.* Progress of the mineral industry of Tasmania, Sept. 1909; March 1910; June 1910. Hobart. 1910.

VICTORIA.

NATIONAL MUSEUM. Memoirs, no. 3. Melb. 1910.

ROYAL SOCIETY OF VICTORIA. Proceedings, new ser., vol. 22, no. 1-2. Melb. 1910.

——— Transactions, vol. 5, pt. 1. Melb. 1910.

VICTORIA. *Department of Agriculture.* Journal, vol. 7, pt. 9-12; vol. 8, pt. 1-9. Melb. 1909-10.

VICTORIA. *Department of Mines.* Annual report of the Secretary for Mines, 1909. Melb. 1910.

—— —— Bulletin of the Geological Survey, no. 23. Melb. 1910.

—— —— Memoirs of the Geological Survey, no. 9. Melb. 1910.

—— —— Records of the Geological Survey, 1909. Melb. 1910.

VICTORIAN GEOGRAPHICAL JOURNAL, vol. 26-7, 1908-9. Melb.

VICTORIAN NATURALIST, vol. 26, no. 5-12; vol. 27, no. 1-5. Melb. 1909-10.

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WESTERN AUSTRALIA.

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ENGLAND.

BRITISH ANTARCTIC EXPEDITION, 1907-09. Report on the scientific investigations, vol. 1, pt. 1-4. Lond. 1910.

CAMBRIDGE PHILOSOPHICAL SOCIETY. Proceedings, vol. 15, pt. 3-5. Camb. 1909-10.

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—— Proceedings, Oct. 1909. Lond. 1909.

LIVERPOOL BIOLOGICAL SOCIETY. Proceedings and transactions, vol. 23. L'pool. 1909.

MANCHESTER FIELD NATURALISTS AND ARCHÆOLOGISTS' SOCIETY. Report and proceedings, 1909. Manch. 1910.

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NATIONAL PHYSICAL LABORATORY. Collected researches, vol. 6. Teddington. 1910.

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ROYAL BOTANICAL GARDENS, KEW. Bulletin, 1909. Lond. 1909.

ROYAL COLONIAL INSTITUTE. Journal, vol. 41, pt. 1. Lond. 1909.

—— Proceedings, vol. 40. Lond. 1909.

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—— —— ser. B, no. 549-58. Lond. 1909-10.

—— Reports to the Evolution Committee, no. 5. Lond. 1909.

—— Yearbook, 1910. Lond. 1910.

ROYAL SOCIETY OF LONDON. *Sleeping Sickness Commission.* Reports, no. 10. Lond. 1910.

UNITED EMPIRE, n.s., vol. 1, no. 1-8. Lond. 1910.

IRELAND.

BELFAST NATURAL HISTORY AND PHILOSOPHICAL SOCIETY. Report and proceedings, session 1908-09. Belfast. 1909.

ROYAL DUBLIN SOCIETY. Economic proceedings, vol. 1, no. 16; t.p. and index to vol. 1; vol. 2, no. 1. Dublin. 1909-10.

—— Scientific proceedings, new ser., vol. 12, no. 14-29. Dublin. 1909-10.

ROYAL IRISH ACADEMY. Proceedings: Section A, vol. 27, no. 11-12; vol. 28, no. 1-2. Dublin. 1909-10.

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EDINBURGH GEOLOGICAL SOCIETY. Transactions, vol. 9, no. 3-4. Edin. 1909.

GLASGOW GEOLOGICAL SOCIETY. Transactions, vol. 13, pt. 1-3. Glasg. 1909.

ROYAL PHYSICAL SOCIETY FOR THE PROMOTION OF ZOOLOGY, ETC. Proceedings, vol. 17, no. 6; vol. 18, no. 1-2. Edin. 1909-10.

ROYAL SOCIETY OF EDINBURGH. Proceedings, vol. 29, pt. 6-8; vol. 30, pt. 1-6. Edin. 1909-10.

AUSTRIA.

KAISERLICHE AKADEMIE DER WISSENSCHAFTEN. Anzeiger, Jahrg. 46. Wien. 1909.

K.K. Geologische Reichanstalt. Verhandlungen, Jahrg. 1909, Nr. 6-18; Jahrg. 1910, Nr. 1. Wien. 1909-10.

K.K. Naturhistorisches Hofmuseum. Annalen, Bd 22, Nr. 4; Bd. 23, Nr. 1-2. Wien. 1907-9.

K.K. Zoologische-Botanische Gesellschaft Verhandlungen, Bd. 59, H. 6-10; Bd. 60, H. 1-3. Wien. 1909-10.

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——— ——— Physique du globe, tom. 4, fasc. 1. Brux.

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Brazil magazine, anno 4, no. 43-5. Rio de Jan. 1909-10.

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——— ——— ——— Summary report, 1909. Ottawa. 1910.

——— ——— *Mines Branch.* Annual report, 1907-9. Ottawa. 1910.

——— ——— ——— Bulletin, no. 2. Ottawa. 1910.

——— ——— ——— Preliminary report, 1909. Ottawa. 1910.

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Nova Scotian Institute of Science. Proceedings and transactions, vol. 12, pt. 2. Halifax.

Royal Society of Canada. Proceedings and transactions, 3rd ser , vol. 2. Toronto. 1909.

CAPE COLONY.

SOUTH AFRICAN JOURNAL OF SCIENCE, vol. 6, pt. 1-10. Cape Town. 1909-10.
SOUTH AFRICAN MUSEUM. Annals, vol. 6, pt. 3. Cape Town.
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ROYAL SOCIETY OF SOUTH AFRICA. Transactions, vol. 1, pt. 1-2. Cape Town. 1910.

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HERBARIUM, no. 10-13. Lpz. 1909-10.
K. BAYERISCHE AKADEMIE DER WISSENSCHAFTEN ZU MUNCHEN. *Mathematisch-physikalische Klasse:* Sitzungsberichte. Jahrg. 1909, Abh. 1-19, Schlussheft; Jahrg. 1910, Abh. 1-4. Münch. 1909-10.
K. PREUSSISCHE AKADEMIE DER WISSENSCHAFTEN. Sitzungsberichte, 1909, 24-53; 1910, 1-23. Berlin. 1909-10.
K. GESELLSCHAFT DER WISSENSCHAFTEN ZU GOTTINGEN. Nachrichten: Geschäftliche Mitteilungen, 1909, H. 1. Berl. 1909.
——— ——— Mathematish-physikalische Klasse, 1909, H. 2-4; 1910, H. 1. Berl. 1909-10.
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NATURHISTORISCHE GESELLSCHAFT ZU NURNBERG. Abhandlungen, Bd. 28, H. 1. Nürnberg. 1909.

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—— —— Bulletin, no. 341, 356, 360, 368, 370-80, 382-93, 395-7, 399-405, 408-14, 416, 418, 421, 423, 424. Wash. 1909-10.
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LIST OF FELLOWS, MEMBERS,
Etc.,
OCTOBER, 1910.

Those marked with an asterisk have contributed papers published in the Society's Transactions.

Any change in address should be notified to the Secretary.

Note.—The publications of the Society will not be sent to those whose subscriptions are in arrears.

Date of Election

Honorary Fellows.

1893. *Cossman, M., Rue de Maubeuge, 95, Paris.
1897. *David, T. W. Edgeworth, B.A., F.R.S., F.G.S., Prof. Geol., Sydney University.
1890. *Etheridge, Robert, Director of the Australian Museum of New South Wales, Sydney.
1905. Gill, Thomas, I.S.O., Under-Treasurer, Adelaide.
1905. *Hedley, Chas. H., Naturalist, Australian Museum, Sydney.
1892. *Maiden, J. H., F.L.S., F.C.S., Director Botanic Gardens, Sydney, New South Wales.
1898. *Meyrick, E. T., B.A., F.R.S., F.Z.S., Thornhanger, Marlborough, Wilts, England.
1894. *Wilson, J. T., M.D., Prof. of Anatomy, Sydney University.

Corresponding Members.

1881. Bailey, F. M., F.L.S., Colonial Botanist, Brisbane, Queensland.
1880. *Foelsche, Paul, Inspector of Police, Palmerston, N.T.
1909. *Johncock, C. F., Orroroo.
1893. Stretton, W. G., Palmerston, N.T.
1905. Thomson, G. M., F.L.S., F.C.S., Dunedin, New Zealand.
1908. *Woolnough, Walter George, D.Sc., F.G.S., Lecturer on Geology in the University of Sydney. (Fellow from 1902.)

Fellows.

1895. *Ashby, Edwin, Royal Exchange, Adelaide.
1902. *Baker, W. H., F.L.S., Glen Osmond Road, Parkside.
1908. *Benson, W. Noel, B.Sc., University of Sydney.
1907. *Black, J. McConnell, Alfred Street, Norwood.
1887. *Blackburn, Rev. Canon Thomas, B.A., Woodville.
1909. Bradley, Edgar J., Civil Engineer, Adelaide.
1883. Brown, H. Y. L., F.G.S., Gov. Geologist, Adelaide.
1893. Brummitt, Robert, M.R.C.S., Gilberton.
1904. Brunkskill, George, Semaphore, S.A.
1906. Bundey, Miss Ellen Milne, 148, Molesworth Street, North Adelaide.
1907. *Chapman, R. W., M.A., B.C.E., Prof. of Engineering, University, Adelaide.
1910. Clark, E. V., B.Sc., Lecturer in Electrical Engineering, University of Adelaide.

1879. *CLELAND, W. L., M.B., Ch.M., J.P., Colonial Surgeon, Resident Medical Officer Parkside Lunatic Asylum, Lecturer in Materia Medica, University of Adelaide.
1895. CLELAND, JOHN B., M.D., Perth, Western Australia.
1907. *COOKE, T. W., D Sc., Lecturer, University, Adelaide.
1907. DARLING, JOHN, Kent Terrace, Norwood.
1887. *DIXON, SAMUEL, Bath Street, New Glenelg.
1902. EDQUIST, A. G., Hindmarsh.
1904. GORDON, DAVID, Gawler Place, Adelaide.
1880. *GOYDER, GEORGE, A.M., F.C.S., Analyst and Assayer, Adelaide.
1910. GRANT, KERR, M.Sc., Professor of Physics, University of Adelaide.
1904. GRIFFITH, H., Hurtle Square, Adelaide.
1896. HAWKER, E. W., F.C.S., Calcanina, Clare (Gladstone Chambers, Pirie Street, Adelaide).
1899. *HIGGIN, A. J., F.I.C., Assistant Lecturer in Chemistry, School of Mines, Adelaide.
1891. *HOLTZE, MAURICE, F.L.S., Director Botanic Gardens, Adelaide.
1883. *HOWCHIN, WALTER, F.G.S., Lecturer in Geology and Palæontology, University, Adelaide.
1910. *JOHNSON, EDWARD ANGAS, M.D., M.R.C.S., Franklin Street, Adelaide.
1893. JAMES, THOMAS, M.R.C.S., Moonta.
1897. *LEA, A. M., Gov. Entomologist, Hobart, Tasmania.
1884. LENDON, A. A., M.D. (Lond.), M.R.C.S., Lecturer in Forensic Medicine and in Chemical Medicine, University, Adelaide, and Hon. Physician, Children's Hospital, North Adelaide.
1856. LLOYD, J. S., Alma Chambers, Adelaide.
1888. *LOWER, OSWALD B., F.E.S. (Lond.), Broken Hill, New South Wales.
1905. *MAWSON, DOUGLAS, B.Sc., B.E., Lecturer in Mineralogy and Petrology, University, Adelaide.
1874. MAYO, GEO. G., C.E., 116, Franklin Street, Adelaide.
1907. MELROSE, ROBERT THOMSON, Mount Pleasant.
1897. *MORGAN, A. M., M.B., Ch.B., Angas Street, Adelaide.
1907. MUECKE, HUGO, C.E., Grenfell Street, Adelaide.
1886. POOLE, W. B. (Hon. Treasurer), Savings Bank, Adelaide.
1908. POPE, WILLIAM, Solicitor, Adelaide.
1907. PULLEINE, R. H., M.B. (Hon Secretary), North Terrace, Adelaide.
1907. PURDUE, R. F., Mining Agent, Launceston, Tasmania.
1885. *RENNIE, EDWARD H., M.A., D.Sc. (Lond.), F.C.S., Professor of Chemistry, University of Adelaide.
1905. *ROGERS, R. S., M.A., M.D., Flinders Street, Adelaide.
1869. *RUTT, WALTER, Chief Assistant Engineer, Adelaide.
1891. SELWAY, W. H., Treasury, Adelaide.
1893. SIMSON, AUGUSTUS, Launceston, Tasmania.
1871. SMITH, ROBERT BARR, Adelaide.
1910. *STANLEY, EDWARD RICHARD, University, Adelaide.
1881. *STIRLING, EDWARD C., C.M.G., M.A., M.D., F.R.S., F.R.C.S., Professor of Physiology, University of Adelaide, Director of S.A. Museum.
1906. SNOW, F. H., Mutual Chambers, Adelaide.
1907. SWEETAPPLE, H. A., M.D., Park Terrace, Parkside.
1904. TAYLOR, WILLIAM, St. Andrew's, North Adelaide.

1886. *TEPPER, J. G. O., F.L.S., Entomologist, S.A. Museum. (Corresponding Member since 1878.)
1897. *TORR, W. G., LL.D., M.A., B.C.L., Brighton, South Australia.
1894. *TURNER, A. JEFFERIS, M.D., Wickham Terrace, Brisbane, Queensland.
1889. VARDON, SENATOR JOSEPH, J.P., Gresham Street, Adelaide.
1878. *VERCO, JOSEPH C., M.D., F.R.C.S., Lecturer on the Principles and Practice of Medicine and Therapeutics, University of Adelaide.
1883. WAINWRIGHT, E. H., B.Sc. (Lond.), McLaren Vale.
1878. WARE, W.L., J.P., Adelaide.
1859. WAY, RIGHT HON. SIR SAMUEL JAMES, Bart., P.C., D.C.L., Chief Justice and Lieutenant-Governor of South Australia. Adelaide.
1907. WEBB, NOEL A., Barrister, Waymouth Street. Adelaide.
1904. WHITBREAD, HOWARD, Currie Street, Adelaide.
1886. *ZIETZ, A. H. C., F.L.S., C.M.Z.S., Assistant Director South Australian Museum, Adelaide.

ASSOCIATE.

1904. ROBINSON, MRS. H. R., "Las Conchas," Largs Bay, South Australia.

APPENDICES.

FIELD NATURALISTS' SECTION

OF THE

Royal Society of South Australia (Incorporated).

TWENTY-SEVENTH ANNUAL REPORT OF THE COMMITTEE

FOR THE YEAR ENDED SEPTEMBER, 1910.

The Section has good reason to congratulate itself upon the work of the past session, both in the field and in the evening meetings.

The scientific results of the session's work are difficult to estimate—in fact, impossible—because the operations are primarily educational rather than research.

Collectors, however, have made valuable additions to their store of knowledge as well as of exhibits. On account of the limitations of field operations, members have to travel abroad alone for scientific research in areas not accessible to the general body of members.

MEETINGS.

Dealing first with the meetings, we have to record that at the last annual meeting we had the pleasure of welcoming Dr. Mawson from his travels to the Antarctic. In response to the welcome, Dr. Mawson spoke of the pleasure of returning to his friends, and gave some interesting anecdotes of his travels, and intimated that, from a scientific point of view, the various branches of work would benefit largely by the observations taken on this great journey.

At this meeting the following officers were elected:- *Chairman*, Mr. W. H. Selway; *Vice-Chairmen*, Mr. J. M. Black and Dr. R. S. Rogers; *Secretary*, Mr. E. H. Lock; *Treasurer*, Mr. S. S. Stokes; *Minute Secretary*, Miss E. Hocking; *Committee*, Mrs. J. F. Mellor, Mrs. R. S. Rogers, Dr. R. Pulleine, Messrs. M. S. Clark, A. R. Errey, J. Willmott, J. W. Mellor, and J. G. O. Tepper; *Auditors*, Messrs. J. S. Lloyd and W. D. Reed; *Fauna and Flora Committee*, Dr. R. S. Rogers, Dr. W. Ramsay Smith, Messrs. Clark, Dixon, Ashby, Lock, Black, Zietz, Edquist, Mellor, and Selway.

The annual address was delivered by the Chairman (Mr. W. H. Selway), the subject being "The National Parks and Forest Reserves of Australia." The information contained in the address had been obtained from all the Australian States, and the collaboration was of a most useful character, in view of the special efforts that have to be made to induce the Government to take a serious national policy of setting aside lands for the preservation of native fauna and flora. Following upon this address Mr. J. G. O. Tepper, F.L.S., gave a lantern address, showing what the Americans have done in the reservation at Yellowstone Park. It was humiliating to Australians to think that the Americans could set aside in this one reserve 6,600 square miles, while it seemed very difficult to induce our Governments to set aside as many acres

At the next meeting Mr. J. W. Mellor read an interesting paper, and gave descriptive remarks upon a journey taken on the upper part of the River Murray by a company of our members. This is a new field of operations. Mr. Mellor dealt particularly with the bird life, having noted fifty-three species. The address was continued at the following monthly meeting.

At the July meeting Mr. A. G. Edquist gave an illustrated lecture upon aquatic life. The utility of the projection lantern was again demonstrated in the lecture, the specimens being shown on the screen alive. The lecture was interesting and instructive.

At the last monthly meeting in August the organization of the Wattle-day League was introduced, and commended as a worthy national sentiment. Mr. R. L. Barringer gave an interesting address upon his journeyings in India during a lengthened stay there, from which he had recently returned. A splendid collection of birds, beetles, moths, and butterflies was exhibited to illustrate the lecturer's remarks upon his experiences while collecting.

Exhibits.

One of the most pleasing features of the monthly meetings is the number and variety of the exhibits tabled for inspection. Amongst the most noteworthy of these may be mentioned the orchid *Calleana minor*, shown by Dr. Rogers, who had received it from Mr. W. Gill, who had found it at Kuitpo, and was recorded for the first time in the State.

The exhibits gave the members the best opportunity of showing their field work in a practical way, and it is satisfactory to note that many of these are taken, not only at the excursions, but during private walks and journeys, and members are willing to give others the benefit of their researches.

Exceedingly interesting were the announcements that Mr. J. M. Black had published a book upon "Introduced Plants in Australia," a work which had been favourably commented upon. Dr. R. S. Rogers had also reprinted by the Education Department a series of articles upon orchids which had been published in the official organ of the Department.

Discoveries of a new or rare character had been brought before the notice of scientists by Mr. H. H. D. Griffiths, Dr. Rogers, and Mr. J. W. Mellor.

EXCURSIONS.

The following excursions had been arranged:—November 6, 1909, Fifth Creek; December 11, Brighton; April, 1910, Marine Trip to the eastern reaches of Torrens Island; June 25, Henley Beach; July 16, to Zoological Gardens and Botanic Park and Gardens; August 13, Blackwood; September 17, Eagle on the Hill; September 24, Slape's Gully.

The membership of the Section has gradually increased through the session, and the total now stands at 120.

W. H. SELWAY, *Chairman.*
E. H. LOCK, *Hon. Secretary.*

TWENTY-SECOND ANNUAL REPORT OF THE NATIVE FAUNA AND FLORA PROTECTION COMMITTEE OF THE FIELD NATURALISTS' SECTION OF THE ROYAL SOCIETY OF SOUTH AUSTRALIA FOR THE YEAR ENDED SEPTEMBER, 1910.

THE KANGAROO ISLAND RESERVE ON FLINDERS CHASE.

Your Committee organized a large, influential, and representative deputation which, on November 16 last, waited on the late Commissioner of Crown Lands (Mr. Coombe) to urge upon him the desirability of extending the area of the reserve to the 300 square miles originally asked for. As a result, the Cabinet approved of an additional 79 miles being added to the block known as the Lighthouse Reserve, making the total area about 140 miles. Plans now published by the Survey Office show the position of this Reserve, which extends eastwards to the DeMole River. Before the session closed the Australian Natives' Association, having a very short time in which to do so, circulated and presented a well-signed petition asking the House to grant funds to fence off the area already promised, to provide a fire-break on the boundary, and for the salary of a resident ranger. It is

very desirable to enlarge the area to the 300 miles, and to vest the whole chase in trustees as early as possible, as the difficulty of securing the rarer fauna yearly increases with the rapid multiplication of foxes on the mainland and the extension of settlement. There will thus be provided not only a health-giving possession for the future population of the city and suburbs, but also an invaluable collection of the Australian fauna when certain species have become extinct elsewhere.

New Bird-protection Reserve.

In compliance with a request made by the Committee the islands in Coffin's Bay, Port Douglas, Mount Dutton Bay, and Kellidie Bay, which comprise breeding-grounds for Cape Barron geese, rock parrakeets, and other birds, were in December last proclaimed a Bird-protection District.

Protection of Opossums, etc.

A letter having been received from the Commissioner of Crown Lands asking the opinion of the Committee regarding a proposal for the protection of opposums, a reply was sent recommending that opossums should be protected throughout the State for a period of five years, but allowing their destruction in gardens and orchards. The rapid destruction of all fur-bearing animals throughout the world indicates that very high prices will be obtainable for their skins in the near future. New legislation will be needed to enable their recommendation to be carried out, and your Committee has been asked for suggestions as to any other amendments they may propose to the Games Act. The views of the Committee have also been sought by the Commissioner regarding a suggestion from the Victorian Gun Clubs' Association that the close season for game should be extended from December 20 to February 28, to bring the South Australian regulations into line with those of Victoria and New South Wales, and the Committee recommended that the alteration should be made for all game birds excepting quail. Subsequently it was intimated that instead of thus lengthening the close season, the names of some of the birds should be transferred to the schedule of totally protected birds. The Secretary, therefore, suggested that the following should be so transferred, namely:—Bee-eaters, native pheasants or mallee hens, black cockatoos of all species, gang-gang cockatoos, pigeons and doves of all species, and bustards or native turkeys. Your Committee has pleasure in reporting that this recommendation is being carried out, and a proclamation will probably be published shortly.

Saml. Dixon, *Chairman.*

M. Symonds Clark, *Hon. Secretary.*

FIELD NATURALISTS' SECTION OF THE ROYAL SOCIETY, SOUTH AUSTRALIA.

Statement of Receipts and Payments for the Year ended September 30, 1910.

Dr.	£	s.	d.	Cr.	£	s.	d.
To Balance brought forward	3	17	0	By Postages	5	7	0
,, Grants from the Royal Society	15	0	0	,, Printing	3	12	0
,, Subscriptions from 1909-10	19	17	6	,, Advertising	1	6	4
,, Bank Interest	0	6	0	,, Fauna and Flora Committee	0	5	0
				,, Lecture-room and Lantern	1	9	0
					11	19	4
				,, Subscriptions paid to the Royal Society ...	19	17	6
				,, Balance in Savings Bank	7	3	8
	£39	0	6		£39	0	6

	£	s.	d.
September 30, 1910—Balance in General Funds ..	7	3	8
Balance in Excursion Account	3	18	1
	£11	1	9

Audited and found correct.

Walter D. Reed, F.C.P.A., Auditor.

Stanley S. Stokes, Hon. Treasurer.

September 15, 1910.

APPENDIX.

THE NATIONAL PARKS AND FOREST RESERVES OF AUSTRALIA.

Being Addresses by W. H. SELWAY, as Chairman of the Field Naturalists' Section of the Royal Society of South Australia, and read at its annual meetings on September 21, 1909, and September 20, 1910.

In thinking over a subject for this address it occurred to me that, as this Section took such an active part in securing the National Park as an inalienable heritage for the people, and so much difficulty was experienced in getting the 2,000 acres or so which comprise the Park; as, moreover, similar obstacles are now being encountered in the effort to obtain what is considered to be a suitable area on Kangaroo Island for a Fauna and Flora Reserve —I thought it would be interesting to see what has been done, and is being done, in the other States in a similar direction. Closely associated with the National Park question is that of Forest Reserves, and in view of the attention this subject is receiving in other parts of the world, notably in Amercia, I determined to include both topics in this address. In America "The Conservation of our Natural Resources" has been receiving the earnest consideration of some of the most capable and thoughtful men of that great country, including that far-seeing and true statesman, President Roosevelt. It is significant that the threat of a wood-shortage first brought home the realization that the natural resources were being recklessly wasted. The forest problem opened the eyes of the people (of America) to the condition of their natural resources as a whole. It was seen that national progress, even national *existence*, depended upon reform in the methods of using the natural riches of the land. As an outcome the Inland Waterways Commission was appointed by the President in March, 1907. This led to a widening of the subject, and a great Conference was held in Washington last year (May, 1908), composed of the Governors of the States and Territories, together with men of national prominence, familiar from experience in business life with the four great classes of resources—the forests, waters, mines, and the soil. The outcome was a "Declaration of Principles," which contains words of wisdom which time forbids me quoting in full, but which are worth the careful perusal of everyone who has his country's welfare at heart. Permit me just to give one or two extracts: "We agree that our country's future is involved in this -that the great natural resources supply the material basis upon which our civilization must continue to depend, and upon which the perpetuity of the nation itself rests." . . . "We agree that the forests, which regulate our rivers, support our industries, and promote the fertility and productiveness of the soil *should be preserved and perpetuated.*" . . . "We urge the continuation and extension of forest policies adapted to secure the husbanding and renewal of our diminishing timber supply." . . . "We recognize that the private ownership of forest lands entails responsibilities in the interests of all the people," and concludes in the words: "Let us conserve the foundations of our prosperity."

In President Roosevelt's last message to Congress he deals with the question of the conservation of the natural resources of the coun-

try, and lays special stress on the preservation of the forests in the following words: "If there is any one duty which, more than another, we owe it to our children to perform at once, it is to save the forests of this country, for they constitute the first and most important element in the conservation of the natural resources of the country." . . . "Short-sighted persons, or persons blinded to the future by desire to make money in every way out of the present, sometimes speak as if no great damage would be done by the reckless destruction of our forests. It is difficult to have patience with the arguments of these persons." When I think of the magnificent eucalypts that have been cut down in our own hills, not more than twenty or thirty miles from Adelaide, for the sake of a few pounds' worth of railway sleepers, I feel disposed to agree with the sentiments thus forcibly expressed.

I am aware that there is a difference of opinion as regards the effect of deforestation on climate, and when we get an exceptional season like the last winter in this State, some may be disposed to think that, forests or no forests, rain is certain to fall. But, as President Roosevelt points out, "all serious students of the question are aware of the great damage that has been done in the Mediterranean countries of Europe, Asia, and Africa by deforestation," and he proceeds to point out that similar mischief has more recently been done in Eastern Asia, especially Northern China: —"Not many centuries ago the country of Northern China was one of the most beautiful and fertile spots in the entire world, and was heavily forested. Now, owing to deforestation of the mountains, there is appalling desolation in the shape of barren mountains and gravel and sand-covered plains. The climate has changed, and is still changing. It has changed even within the last half century, as the work of tree destruction has been consummated. Briefly this has been brought about in this way—the great masses of arboreal vegetation on the mountains formerly absorbed the heat of the sun, and sent up currents of cool air, which brought the moisture-laden clouds lower, and forced them to precipitate in rain a part of their burden of water. Now that there is no vegetation the barren mountains scorched by the sun send up currents of heated air, which drive away, instead of attracting, the rain clouds, and cause their moisture to be disseminated. With lack of rainfall crops wither, and as the air becomes dryer some refuse to grow at all. The water-courses have also changed, for the roots and humus of the forests caught the rain-water and let it escape by slow regular seepage, but now, when it rains, these are freshets; the rich soil which took thousands of years to form is washed away, and muddy torrents rush down bearing disaster and destruction everywhere. What has happened in Northern China, what has happened in Central Asia, in Palestine, in North Africa, and in parts of the Mediterranean countries of Europe will surely happen to our country [and, let us add, to Australia], if we do not exercise that wise fore-thought which should be one of the chief marks of any people calling itself civilized." Listen to these weighty words of the Ex-President of the United States: —"Nothing should be permitted to stand in the way of the preservation of the forests, and it is criminal to permit individuals to purchase a little gain for themselves through the destruction of forests, when that destruction is fatal to the well-being of the whole country in the future."

I may here state that in thinking about this matter, before I had read anything of this Conservation Commission in America,

this idea occurred to me:—Should a State allow the occupiers of forest land or land bearing large timber, be they lessees of the Crown or private owners, to do just as they please with trees which may have taken hundreds of years to come to their present maturity, or should not some restriction be placed on the occupiers, much in the same way that the owner of country through which a river (another natural endowment) may flow is not at liberty to do all he may like with the water passing through his property? As there are riparian rights, why should not the whole population, who may eventually suffer by the indiscriminate destruction of forests, be protected against the ignorance, stupidity, or greed of their fellow men? Fortunately we cannot easily lay hold of the constituents of the air we breathe, otherwise some enterprising (!) men might establish a "corner" in oxygen, or appropriate the nitrogen for plant fertilizers!

I think I have stated sufficient to indicate how important to the well-being of a country is the preservation of sufficient tracts of forest land. In addition to this general and climatic influence, other considerations may be advanced—there is the æsthetic aspect—the beauty of the scenery in its natural state, and here I recall how much of the natural beauty of our Mount Lofty Range —not to go farther afield—is being marred by the destruction of the timber once adorning its hills and dales. How pitiable is it to see acres upon acres of dead timber probably ring-barked. I am told, too, that between Mount Lofty and Mount Barker many of the trees on the roadside affording so grateful a shade in our hot summer months, are being cut down by District Councils, because some slight damage may be done to the road by the rain dropping from the over-hanging branches. In contradistinction to this, I was pleased to see that in the pretty township of Hahndorf the main street is planted with an avenue of umbrageous trees. Reference might be made to the value of the eucalypt, from a health point of view, rendering swampy ground free from malaria, and I notice that the French Government is planting in Southern France, Algeria, etc., what they describe as "these beautiful slender trees," to counteract the deforestation of those parts. As a profitable investment alone, forests are worth conserving and establishing. Great Britain even has come to realize the pressing importance of the timber question, and a Commission which enquired into the subject some time ago, recommended that £2,000,000 a year should be spent on afforestation, and expressed the opinion that the tendency of the supplies of timber to diminish would continue, and that in the present century a steady and very considerable rise in prices may be looked for.

Dr. Holtze, the Director of our Botanic Garden, thinks £25,000 a year, for say 20 or 25 years, should be spent by us in establishing forests, and that such an expenditure would be a very handsome paying investment, as £200 an acre may be obtained in some cases. In 10 or 12 years some of the trees could be utilized for poles, etc. A tree will grow here as much (says Dr. Holtze) in 30 years as it would do in Germany in 60 years. Then quite recently we have had allies from another source, and very enthusiastic allies, too, *viz.*, the Bee-keepers' Association, because from the flowers of the eucalypts most of the honey is obtained, and the apiarists naturally look with alarm on the destruction of those trees from which this wholesome food supply is obtained. Did time permit, one might refer to the importance of these trees as affording food, refuge, and building-places for the birds, whose

place in the economy of Nature is of so much importance, and, alas, so little realized by the majority of people.

Having thus referred at some length to the importance of forests, let me now allude to the subject of

National Parks.

As I said at the beginning, they are inter-related, because each park is, or ought to be to some extent, a forest reserve. But it is more. It is, if properly conducted, a safe refuge (a sanctuary) for our native fauna and flora. As most of you are aware, the fauna and flora of Australia are unique, being to a large extent the living representatives of those bygone ages, the remnants of which are elswhere buried in rocks many hundreds of feet below the surface. May I just mention such creatures as the kangaroo, opossum, the echidna, platypus, the marsupial mole, the emu, bower bird, lyre bird, laughing jackass, pelican, and penguin. Then, in the order of plants, the gums, acacias, pea-like and heath-like flowers, and the beautiful and curious orchids, etc. *Twenty years ago* the importance of preserving the indigenous plants and animals was emphasized in a series of interesting articles written for the Register by one of our then members, the late Mr. A. F. Robin, of whom I shall have more to say later, and who indicated various means by which the preservation might be effected. Mr. J. G. O. Tepper, F.L.S., I understand supplied Mr. Robin with much useful information on the subject. Foremost among the methods advocated was the reservation of large areas as National Parks. "The chief merit," said Mr. Robin, "of such reserves is that they serve the purpose specified in the most natural way by retaining to a great extent the primeval beauty of the country. And the beauty of our land is like that of no other. With the vanishing of our native fauna and flora will pass types not differing but little from those of other parts of the world, but in a large measure essentially distinct." This disappearance is reiterated in the latest book just published on "The Animals of Australia," by A. H. S. Lucas and W. H. Dudley Le Souef, who say "the kangaroo and wallaby are going. Last week there passed through the Sydney market alone the skins of 58,000 native bears, over half a million kangaroos and wallabies," and we hear later that opossum slaughter is again in full swing, as much as £15 a week being made from this source.

Of course, the popular conception of a National Park is a place for recreation, and this idea has grown and developed to such an extent in regard to our own park that when one sees or hears of the thousands who visit it on public holidays, and in lesser numbers, but still considerable, on other days, one wonders where these crowds went before the National Park was available. A people's playground is a very desirable and beneficial undertaking, but it was, of course, not the main objective when this Section laboured to secure this reserve. That objective was the preservation of our native fauna and flora.

I shall, in the first instance, make a few observations on our own National Park, and then proceed to deal with those of other States.

The National Parks of South Australia.

BELAIR.

This has always had a warm place in the hearts of the members of this Section. It was to that place, then known as Government

Farm, that its first excursion was held, *viz.*, on November 24, 1883, under the leadership of the late Professor R. Tate, F.G.S., and probably no succeeding year has passed without at least one visit being paid to it. The history of the movement for securing this park has been written fully and fairly by Mr. M. Symonds Clark, and published in the S.A. *Register*, of October 7, 1901. I think, however, that such an account, together with still further information that has since been acquired and embodied in the ably compiled, well-printed, and admirably illustrated booklet issued by the Tourist Bureau, should form part of our own records, by being read as a paper before us, and printed in our proceedings, as was done by the Field Naturalist Club of Victoria with regard to their National Park at Wilson's Promontory. In the history of the park, as given in the Tourist Bureau's publication, the only reference to our part in securing this reserve is the following:—"The support of the Australian Natives' Association, and of the Field Naturalists' Section of the Royal Society, was obtained (when the proposal to cut up the Farm in 1881 was made), and an Act prohibiting the sale of the Government Farm was passed in 1883." Historically this is inaccurate, because this Section was not established till the end of 1883, and did not take any action in this matter until five years later (1888). The Australian Natives' Association is not mentioned among the ten societies to which, as then Secretary of this Section, I wrote in pursuance of a resolution of August 30, 1888, asking them to join us in a deputation to the Government. Later, however, in 1891, the A.N.A. did organise a deputation to protest against the improper destruction by the Forest Department of timber on the Government Farm. In the official Bulletin No. 4 of the Department of Intelligence of this State, published November, 1908, in which brief space is devoted to the history of the Park, no mention whatever is made of the part taken in it by this Section. I said that Mr. Clark's account was fairly written. It was written to correct misleading statements in a previous article in *The Register* as to how the Park was secured, and though that (previous) article gives all the praise to Mr. Walter Gooch, Mr. Clark, while very properly giving that gentleman all credit for what he had done, also very properly sets forth that the persistent exertions of the late Mr. Arthur F. Robin, the then Secretary of the Flora and Fauna Committee, led to the Park being vested in trustees—the suggestion of trustees being first made by Mr. S. Dixon, the chairman (ever since its formation) of the same committee. Being Secretary of the Section at the time Mr. Robin was Secretary of the Flora and Fauna Committee I can confirm what Mr. Clark has said. My position as a civil servant prevented my taking an active and visible part in what was largely a political matter, but Mr. Robin and I were in very frequent consultation about the Park movement, and other questions connected with our native fauna and flora. When future generations desire to do honour to those who secured the Park for the people, the names of Mr. Walter Gooch, Mr. Samuel Dixon, and Mr. A. F. Robin should certainly not be omitted. The inclusion in the deputation referred to above, composed largely of learned societies, of such bodies as the Trades and Labour Council and the United Friendly Societies was to strengthen our hands from the recreation point of view, but as I have already said our main objective was the protection of our native fauna and flora. Many of us think it a matter for regret that this has been made

to take quite a subsidiary place, compared with the play-ground aspect.

Although, of course, there is a certain amount of preservation in the whole park, only two small enclosures, each about three-quarters of an acre in extent, have so far been made for the special preservation of the flora, while no enclosure whatever has yet been made for the fauna. The estimated cost of a suitable fence is £300, and there would be some small additional sum required for the care of the animals. When we hear of £400 being spent for the erection of a kiosk in the Park (probably a desirable work) some of us think the cost of fencing a suitable enclosure (£300) not very extravagant. If no public-spirited citizen is willing to donate this amount, could not an instalment be set aside annually out of the Park Funds, until the required sum is reached. Later on I will show how differently they view this subject in New South Wales.

Although the by-laws of the Park prohibit the taking or destruction of all native plants (and probably there is no other area of equal size near Adelaide so rich in orchids and other native flowers as this, unless it be the adjacent neighbourhood of Blackwood), the restrictive measures seem to be directed chiefly against the taking of fern. Why, I cannot understand! I suppose all the varieties of fern to be obtained there are to be seen in any conservatory, but in what green-house will you see our native orchids successfully growing? Apart from the question of flowers, I hope that a portion of the Park (say the eastern or north-eastern end) will be left as far as possible in its *natural state*, so that succeeding generations will have an opportunity of seeing a sample of virgin forest, when all the surrounding country is transformed into gardens, orchards, etc. Let us keep a bit of *Nature's garden* intact!

For purposes of record, though it may be familiar to most of you, let me just say that the National Park at Belair is eight miles from Adelaide by road (13¼ by rail), is situated in the Mount Lofty Ranges, contains about 2,000 acres (about three square miles), that it was dedicated as a public recreation ground in December, 1891, the date the National Park Act was assented to being December 19, 1891. This Act vested its management in 12 Commissioners, of whom five are appointed by the Governor, and amongst the rest the President of the Royal Society is one of the official members. It has been called a "spacious playground," and when I mention that there are four large ovals, seven cricket pitches, and 21 tennis courts, it will be apparent that the designation is justified.

One respect in which the Park, as regards its natural features, seems deficient, as compared with mountain scenery of the other States, is the absence of tree ferns. Mr. F. G. A. Barnard, so long connected with the Victorian Field Naturalists' Club, whom I had the pleasure of conducting over the Park recently, expressed the opinion that the gully between the railway embankment and the first waterfall would be a suitable place in which to grow these beautifiers of the landscape. It is certainly worth trying.

KANGAROO ISLAND.

In the report of the Fauna and Flora Committee for 1896, it was mentioned that the Australasian Association for the Advancement of Science had recommended that the Cape Borda Lighthouse Reserve should be dedicated to the preservation of

native fauna. In reply to an enquiry of the secretary of that committee, the secretary to the Commissioner of Crown Lands stated that as the reserve was required as a fresh food supply for the light-house keepers the Board could not agree to the dedication. After a lapse of some years, it was mentioned in the 1905 report of the Fauna and Flora Committee that application had been made for the reserve as a cattle station, but on the committee's representation this was refused. In 1906 the matter of securing the reserve was taken up in earnest, an important meeting was held in the Mayor's parlour on July 25. A resolution was passed as to the desirableness of securing the western end of the island both as a reserve for fauna and flora and as a health resort. On August 7, 1906, a deputation waited on the Premier (the late Hon. T. Price), who promised the 60 square miles (Light-house Reserve), and gave some hope of the larger area (*viz.*, 300 square miles) being granted. On August 15, 1906, a suggestion was made to the Premier that eight trustees should be appointed. In the following year further efforts were made, for on April 20, 1907, Messrs. T. H. Smeaton, M.P., S. Dixon, and E. Ashby had an interview with the Premier, who stated that owing to the high price demanded by the lessees of portion of the 300 square miles for the surrender of their holdings, the Cabinet could grant only the Light-house Reserve, containing 60 square miles. Subsequently a letter was sent to the Premier, in which it was recommended that various divisions of Natural History be represented on the suggested Board of Trustees.

On December 26, 1907, the Cape Borda Light-house Reserve of 67 square miles was set apart by proclamation for the purpose of protecting and preserving the fauna and flora. On January 11, 1908, a deputation waited on the Commissioner of Crown Lands urging that the larger area of 300 square miles should be set aside, but that gentleman considered that the area promised was sufficient. Twice Mr. E. Ashby wrote to the Acting Premier setting out reasons for granting the larger area and enquiring as to the appointment of trustees. The reply was (from our view) not very satisfactory, for it stated that the area could not be increased, but that later on the land might be vested in a more suitable body, the Marine Board control being a temporary arrangement. It was pointed out in the Committee's report that the alarming increase of foxes all over Australia rendered the need of the larger area more urgent than before, as the ground birds would probably be extinct if their enemies continued to increase as they have done in late years.

In their 1909 report the Committee anticipated that the promises made by the late Hon. T. Price to the deputation on August 7, 1906, would be carried out on the lines of the scheme drawn up at his desire. Attention was again called to the spread of foxes on the mainland. The committee again pleaded for 300 square miles. On November 16, 1909, a large and influential deputation, organised by the Fauna and Flora Committee, waited on the then Commissioner of Crown Lands (Mr. E. H. Coombe, M.P.), to urge the desirability of extending the area to the 300 square miles originally asked for. As a result the Cabinet approved of an additional 79 miles being added to the block known as the Light-house Reserve, making the total about 140 miles. Before the Session closed the Australian Natives' Association circulated and presented a numerously-signed petition, asking the House to grant funds to fence off the area already promised,

to provide a fire-break on the boundary, and for the salary of a resident ranger. The committee again emphasized the importance of vesting the reserve ("Flinders Chase," as it was suggested it should be called) in trustees as early as possible, as the difficulty of securing the rarer fauna yearly increased with the rapid multiplication of foxes on the mainland and the extension of settlements.

At length, on February 10, 1910, the reserve at the west end of Kangaroo Island was gazetted as a Fauna and Flora Reserve. Its area, I am officially informed, is 146 square miles (93,440 acres), a considerable advance on the 67 square miles previously granted, and showing that the persistent efforts of the Committee had not been in vain. This is very satisfactory as far as it goes. We wished it had been larger and still hope in that direction. We would also much prefer to have it vested in trustees, as in the case of the Belair Reserve, as it then seems more secure from alienation, although I am informed that the powers of the Commonwealth are practically unlimited as to what it can acquire in the way of land. Now that the Kangaroo Island Reserve is proclaimed it seems desirable that further action should be taken, by preventive by-laws, to secure from destruction, not only existing fauna and flora, but whatever native animals or plants may subsequently be introduced. It may be added that, as a whole, the western end of the island is not considered suitable for agricultural purposes, although there are some rich patches. Deprivation to intending settlers, therefore, would be slight, while as a sanctuary for game, etc., the country is on many grounds peculiarly suitable.

OTHER RESERVES.

In addition to the two large areas (Belair and Kangaroo Island) already mentioned, there are a number of smaller reserves in this State amounting to something under 1,000 acres, such as the reserves at Brownhill Creek, Waterfall Gully, Mount Lofty Summit, Port Noarlunga, Echunga, 100 acres adjoining Marble Hill, and 120 acres at the Naracoorte Caves.

It may be mentioned that, under the Birds' Protection Act (745, of 1900), several islands, mostly on our western coast line, have been proclaimed as "Birds' Protection Districts."

NATIONAL PARKS OF VICTORIA.

The struggle to secure Wilson's Promontory as a National Park for Victoria strongly resembles that in which we ourselves were concerned, but the struggle in their case seems to have been more prolonged. For 20 years the proposal was before the public without much progress being made, and deputations and public meetings were necessary to counteract other influences which sought to cut the area into blocks. Amongst these must be mentioned the efforts of a lady (Mrs. Gordon Baillie) who endeavoured to secure 45,000 acres near the Promontory as a settlement for some 1,000 Skye Crofters. The pioneer and prime mover for securing the reservation appears to have been Mr. J. B. Gregory, a member of the Field Naturalists' Club, and upon that Club rested the main work of attacking opposing strongholds, and of bringing Ministerial minds to a proper sense of their duty. Professor Baldwin Spencer, a president of the Royal Society of Victoria, then took an active part as a speaker at deputations

and public meetings, letters to the press, etc. At one influential meeting in the Athanæum no less a personage than the Lieutenant-Governor (Sir John Madden) presided. More deputations, mostly of scientific associations, followed, till at last, in December, 1904, Cabinet decided on making a permanent reservation, amounting to about 75,000 acres. This was not quite satisfactory, because a strip of land, half a mile wide, from the coast line, was only temporarily reserved. Neither was the park vested in trustees. Without this half-a-mile strip, extending along the shore line, the park would have been robbed of the necessary protection. To secure these two desiderata, as well as the appointment of a ranger, meant further agitation, and so Professor Spencer again came to the front. A conference of all societies and institutions interested was arranged, and another deputation waited on the Minister of Lands (Mr. Mackey) on December 18, 1907. He agreed as to the trustees and ranger, but would not consent to the half-mile strip. Another conference was held and submitted nominations for trustees, which names the Minister approved, but constituted them a *Board of Management*, instead of *Trustees*, as was wanted. I presume in this way the Government still retains the control, and that it is not so satisfactory as being vested in trustees, as in the case of our own park. The board consists of a representative of each of the eight societies and institutions taking part in the movement, and Professor A. J. Ewart (a Vice-President) represents the Victorian Field Naturalists' Club. A few months later it was reported at the Field Naturalists' Club meeting on September 14, 1908, that Professor Baldwin Spencer had been elected chairman of the Board of Management of the Wilson's Promontory National Park, and that at length as a result of further representations the Minister of Lands had decided to add almost the whole of the half-mile strip along the coast line, reserving a few small areas at certain bays as landing places for fishermen and others. Also a sum of money had been granted for expenses of management. And thus practically all that was wanted has been granted only (in its final stage) a year ago. The latest map shows that the area is 101,000 acres. Our advocates for the Kangaroo Island Reserve should take courage from this successful result of perseverance.

This park differs very much from our own. Though it has dense fern gullies, some well-wooded hills, and much beautiful scenery, it is too distant from the metropolis to be a place for a day's holiday outing for the people. It has, however, some 60 miles of coast line, and later on may become a holiday resort for those who can spend a week or two, or even a few days, from their daily occupation. Meanwhile, from the point of view of the preservation of the native fauna and flora, it is an ideal place. In 1908 the National Herbarium undertook to make a complete botanical survey of Wilson's Promontory, and in October of that year the first excursion for that purpose was made, and did a lot of useful work. The total number of plants recorded for the park now amounts to 364, probably nearly a fourth of the flora of Victoria. (Before it is too late, could not we make a similar census for our park?) Other departments of Natural History are well represented, no fewer than 83 species of birds being noted, more than 20 native bears, some bandicoots, and a fair number of wallabies. Both deer (introduced many years ago) and lyre birds were heard, but not seen.

Referring to this Park, Mr. Barnard, in writing to me, states that "Our (Wilson's Promontory) Park will never be a place of amusement like yours. You see it is 125 miles from Melbourne. At present it is never visited, but as time goes on. I hope a hospice may be established there, so that folks can go and admire the scenery and game, etc., when stocked. We really have nothing like your park in Victoria. The nearest approach is the reserve at Fern Tree Gully, 23 miles from Melbourne, at the south end of the Dandenong Ranges. Its area is about 800 acres, nearly all of which is steep hills covered with timber, scrub, ferns, etc. Only about an acre at the bottom is available for playground."

Referring to the value of Wilson's Promontory for preserving many species of plants from extinction, Professor Ewart says that "it is sincerely to be trusted that none of our endemic species will be suffered to become absolutely extinct, when a special harbour and sanctuary exists for them. A species once extinct cannot be revived by any means, and to allow plants to become extinct before all their economic possibilities had been thoroughly tested, is a wanton wasting of the hidden treasures which Nature scatters lavishly around us."

In New Zealand there is a Scenery Preservation Board, on whose recommendations a great number of reservations along river banks and railway lines have been made on one river 54 reservations, amounting to 46,500 acres. Up to March 31, 1908, 117 reservations had been made in various parts of New Zealand, amounting to 34,000 acres. Much of the land had to be repurchased at a cost of over £15,000.

This example has been followed in Victoria, where the National Parks' Association was inaugurated in December of last year (1908). Since then the executive, which is composed of representatives of the various scientific societies of Victoria, has been steadily gathering information as to desirable places for reservation. This, perhaps, is beyond the scope of our Fauna and Flora Committee, but something might and ought to be done in this way in this State before it is too late. Shall we enlarge the scope of our Committee, or try an amalgamation of various societies likely to be interested?

In dealing with the State of Victoria, I have referred only to the National Park at Wilson's Promontory. The information I gave was obtained partly from a careful perusal of the "Victorian Naturalists" for some years past, in which magazine reference to the steps taken to secure this splendid reserve was made from time to time, and partly from correspondence with a personal friend in Melbourne. Now that I have before me the official reply to my questions sent to that capital, I find that there are *seven* National Parks in Victoria, having a total area of 166,300 acres. With the exception of a comparatively small area at Tower Hill of 1,360 acres, which was proclaimed in 1892, and is chiefly a tourist resort, all of these reserves were proclaimed either in 1908 or 1909, three of them as recently as October of last year. A feature of special interest to us is that the chief reason of these recent reservations was for the purpose of protecting the native fauna, showing, it would appear, the advance of public opinion on this subject. These parks seem to be well distributed through the State, and embrace mountain, sea coast, lake, and island, the last being known as Snake Island. Whether the snakes, from which presumably the place

takes its name, are included in the fauna which are protected is not stated. One of the reserves is at the Buffalo Mount, in the Australian Alps, near which I spent a holiday some years ago, making my headquarters at Bright. I saw by one of the papers, I think last year, that the Government was going to build a hospice on the summit of the Buffalo, to cost £10,000. I stayed at the hospice of Mount St. Bernard, another high elevation in the same district.

I learn from answers to my questions that in none of these parks are any games provided, but such are proposed in the case of the Buffalo Reserve. There are no foreign trees planted (unlike the case with our own park), there are no enclosures for native animals, and none of them are placed beyond the control of Parliament. In the Buffalo reserve the fauna and flora are protected, in three others the Fauna, while the remainder—two of them coastal—are chiefly tourists' resorts and no special protection is given to the fauna and flora.

In addition to these seven parks, there are seven other reserves of smaller area, which are described as "akin to National Parks." Most of them, such as Fern Tree Gully, Werribee Gorge, and Mount Franklin, are in the nature of public parks or recreation grounds, while one (Buchan Caves) serves the additional purpose of protecting the *natural features* of the locality, and one (Mount Towrong) is reserved for *climatic purposes*—whether as a sanatorium or for meteorological reasons is not stated, I think probably the former. The total area of these smaller reserves is 2,919 acres, making, with those just mentioned, a grand total of 169,219 acres. I think you will admit that Victoria is well off in the provision made there for National Parks.

It may be added that there are also about 30 sanctuaries for game proclaimed under Game Acts, in which it is unlawful for any person to kill or destroy native game. This must be very satisfactory to those persons interested in the protection of our native birds, provided always that the Act is strictly observed.

National Parks of New South Wales.

Of all the National Parks in Australia, probably that of Port Hacking, near Sydney, is the best known, both from its extent and its beauty. Whereas our own park at Belair contains slightly under 2,000 acres that at Port Hacking is 36,300 acres in extent.

It is not so generally known that another park of even greater dimensions is to be seen about the same distance north from Sydney as Port Hacking is south from that metropolis. I shall first give a few particulars about each of those splendid parks and then quote a report on them and other reserves kindly supplied by the tourist officer at Sydney.

Port Hacking.

This is said to be one of the most magnificent recreation grounds in the whole world. In point of size it is said to be only second to the great Yellowstone Park in the United States, but I note that Kuring-gai Chase is a somewhat larger area. For beauty of forest and coastal scenery it is unsurpassed, and it enjoys in addition the all important advantage of accessibility, since the vast area of 36,300 acres lies only 16 miles south from Sydney. It has a large stretch of ocean beach on its east,

while the Port Hacking River runs practically right through from north to south of the enclosure. It consists mostly of high table land, from 350 to 900 feet above sea level, divided by deep glens and gorges, and these valleys possess a wealth of picturesque and quiet beauty. The trustees spare no pains to preserve the beautiful flora and fauna, and birds, animals, and plants must not be interfered with. On this point the chairman of the National Park Trust (Mr. Frank Farnell) in his report for the year ending June 30, 1908, remarked, "The remedy for the too frequent inclination to ruthlessly destroy our native fauna and flora suggests itself in engrafting in the minds of the children attending our public and other schools the importance and value of preserving for those in the future our harmless, indigenous animals and birds, and giving protection to our native flowers. What with the spread of population, and the use of means for destroying pests, our native bird and animal life is in danger of extermination. . . . It, therefore, is apparent that there should be one place at least where all the different species of our native fauna should be left unmolested and free from the many sources of destruction affecting other parts of the State. It is very gratifying to know that the rest and freedom from the pot-hunter is responsible for the animal and bird life multiplying and becoming quite a feature of the park. The kangaroos, wallabies, emus, lyre birds, pigeons, doves, thrushes, swans, ducks, deer, etc., may be seen at any time lending an appearance of loss of timidity and appreciation of the protection afforded them. So tame have some of them become as to eat food from one's hand. There is no reason why hundreds more should not make the park their permanent home, and with that in view the trustees are arranging for additional bird and animal life to be introduced from other parts of the State."

KURING-GAI CHASE.

The object in dedicating this area was in the first place to protect for posterity the natural flora and fauna of this part of the State, and to preserve for the public a most beautiful pleasure resort within easy reach of the metropolis.

Some of the finest scenery in New South Wales is included in its boundaries. It has the great advantage of having a large water-frontage, and is intersected by numerous bays and creeks. It has Pitt-water, a sea beach, on the east, and the Hawkesbury River on the north, while Cavan Creek, an arm of the latter, runs nearly its whole length from north-east to south-west. It is from Cavan Creek that Nature has provided the most enjoyable means of seeing the Chase. The scenery in this Creek and its tributaries is wild and grand, somewhat reminiscent of the Scottish Lochs. The shores are very steep, and in places precipitous, towering hundreds of feet on either bank, and covered with timber and verdure to the water's edge. Fern-clad gullies bright with Christmas bush and other wild flowers, sandy beaches for bathing, and grassy slopes for picnicking all exist in the Chase.

REPORT BY TOURIST OFFICER, SYDNEY (MR. C. D. PATERSON), ON SCENERY PRESERVATION IN NEW SOUTH WALES.

Large tracts of land, specially adapted for recreation reserves but unsuitable in almost every instance for cultivation or settlement from an agricultural or pastoral aspect, have been set apart

in this State and dedicated to the public as national reserves. These reserves are generally vested in trustees, usually consisting of prominent local men, who, with the aid of private subscriptions and subsidies received from the Government, carry out all necessary work, such as roads, tracks, and shelter sheds for the benefit of the visiting public.

The two more important reserves in the vicinity of Sydney are National Park (33,719 acres) and Kuring-gai Chase (35,300 acres). Here the trustees, in addition to providing facilities for visitors, have taken steps to preserve the natural flora and fauna committed to their care, making it a penal offence to discharge firearms or to interfere in any way with the birds and animals in the parks. No one is allowed without the permission of the trustees, to remove, cut, or deface trees, shrubs, plants, rocks, fences, or gates, to fish in prohibited waters, advertise or depasture stock. Employés are sworn in as special constables to enforce these laws, and it is found that this policy of preservation has been successful in making the parks the haunts of great varieties of beautiful birds and other fauna.

The same principle is followed on a smaller scale at reserves of well-known beauty spots, and these trusts have been able to effect marked improvements with the comparatively small funds at their disposal. From time to time a specially constituted Board pays visits of inspection to these reserves, the Government being largely guided by the Board in making grants to the various trusts according to their special requirements.

These trusts make their own rules and regulations, particularly emphasizing the fact that the natural flora must not be interfered with, and where funds allow it employés acting as special constables enforce this, or, in other instances, the trustees acting in an honorary capacity endeavour to preserve the natural beauties. Considerable areas of land have been proclaimed reserves in the vicinity of the principal limestone caves —Jenolan, Yarrangobilly, and Wombeyan, as well as at the smaller caves at Bungonia, Abercrombie, and Wellington. These caves are all under the control of the Intelligence Department, and are in charge of permanent employés—caretaker and guides—who are all special constables. Stringent regulations are in force for the preservation of the natural formation, as well as of the flora and fauna, and any persons found guilty of vandalism are prosecuted. Where other limestone caves are known to exist reserves have in many instances been proclaimed, and in order to prevent vandalism the openings of the caves have been blocked until such time as the demands of the tourist warrant their being improved and thrown open. Occasionally caves are discovered on alienated land; but it is only in very exceptional cases, where the caves are particularly attractive, that any resumptions are made, the entrances being sealed up to prevent the destruction of the formations by ruthless vandals.

It has been the aim of the Government to devote the most attention to the three principal series (Jenolan, Yarrangobilly, and Wombeyan), and large sums of money have been spent on the development and improvement of these resorts, especially the first-mentioned. These caves are considered as national assets, and will in time be a source of a large direct revenue, as well as an indirect return through the railways, etc.

The other caves are mainly of local interest, few persons outside the residents of the surrounding districts visiting them, when the more attractive caves are equally accessible. These caves will no doubt eventually be taken over and managed by the respective Shire Councils, in which event the reserves will probably be vested in the Councils as trustees.

Queensland.

Coming to the State of Queensland I learn that there are six (6) National Parks in that State, having a total area of 26,545 acres, a very small extent compared with Victoria or New South Wales. One of these alone, Bunya Mountains, has 22,500 acres, so that it will be seen that the remainder must necessarily be small—a little over 4,000 acres altogether. The smallest is 135 acres and is situated near and known as *Killarney*. Amongst them are the Fairy Bower and Mill Stream Falls, so that it is not surprising to learn that the chief reason for reservation is for scenery, coupled with (I am glad to add) the preservation of timbers and native flora.

The Director of Forests at Brisbane informs me that these parks are inalienable, except under authority of an Act of Parliament, that the land is not vested in trustees, the native fauna and flora are to a large extent protected, not so much by law as by the distance of the National Parks and State forests from large centres of population, but it is proposed to bring them under the provisions of the Native Birds' Protection Act. There are no enclosures for native animals in any of these reserves, no foreign trees are planted in any of them, and the chief objects of reservation are the preservation of native timber trees, and on account of scenic features.

When mentioning the relatively small area of National Parks in Queensland, I should perhaps explain that in that State they group State forests and National Parks together to distinguish them from what they call "Timber Reserves," and I have not included the former in my figures. In fact, there is an Act styled the "State Forests and National Parks Act (1906)." From the able report of the Queensland Director of Forests for 1908, I find that there are 816,272 acres under the heading of "State Forests and National Parks," which are comprised under 10 different districts.

Western Australia.

It only remains to speak of the State of Western Australia as regards National Parks, and here we find a somewhat different classification, the division being threefold, *viz.*, National Parks, Flora and Fauna Reserves, and Forest Reservations. This is a distinct advance from our point of view, because in all other States the flora and fauna protection, if any, occurs in those enclosures which are essentially National Parks. In Western Australia I find that under the designation of National Parks there are only two, and one of these is metropolitan, *viz.*, King's Park, which is a reserve of 1,018 acres close to Perth, but it is included in my list because the native fauna and flora are wholly protected therein. I think it is unique for any Australian city or other city of which I am aware, to have contiguous to its capital a reserve, which is not only a picturesque locality for walking or driving in, but in which the indigenous flora is pro-

tected. In this park the strange and beautiful Kangaroo's Paw (*Anigozanthus Manglesii*) grows plentifully. I can remember that within our own suburban area were to be found some years ago quite a large number of our native flowers, and even in our park lands the sweet-scented *Arthropodium Strictum*, and others, are still to be found. Would it not have been a wise action in the past, if two or three acres in each of the broad belts of park lands that surround our fair city had been fenced off so as to have given protection to our wild flowers, and so have perpetuated species which, if not extinct, have now to be sought at a distance from the metropolis. I think Perth is to be congratulated for its wisdom and forethought in not only securing a beautiful park (which I am pleased to see is vested in a Board) but in which the indigenous flora is to be permanently preserved. In this park the recreation element is not ignored, for provision is made for tennis, bowls, and cricket, in connection with the High School.

The only other area described as a National Park in Western Australia is a reserve of 3,420 acres at Swan View, which is classified A under the Permanent Reserves Act, of 1899, and only an Act of Parliament can interfere with its security. I have obtained a copy of the clause in the Act referred to, which briefly provides that the Governor may, by notice in the *Government Gazette*, reserve lands for the purpose of parks, or for recreation, etc., and classify such lands as of *Class A.*, and if so classified, shall for ever remain dedicated to the purpose declared in such notice until otherwise provided by an Act.

The land at Swan View is, I am informed, unimproved, and mostly bush and granite rock, and the fauna and flora are partially protected. I need hardly add that in such country no provision is made for games.

While speaking of National Parks in Western Australia, I may say that I have recently received a letter from a resident in Perth asking for information about our Kangaroo Island Reserve, and intimating that he is trying to establish a National Park there to take in the Stirling Ranges (*1,400 square miles*), and some other sites for preservation of the native fauna and flora.

Coming to the special Flora and Fauna Reserves, I find there are five of these. Two of them—one at Barrow Island, of 50,000 acres, and one at Murray, of about *160,000 acres*—are for the protection of native flora and fauna *generally*. While two small areas of nine and 10 acres, near Albany and at Plantagenet respectively, are for the *special* purpose of protecting the *Pitcher Plant;* and another area of 100 acres near Mount Barker in the Plantagenet District, is to preserve the *Boronia.* So much is the Boronia admired for its fragrance, that were not some action taken for its preservation, its extermination would probably have been effected at no distant date. The reserves for both the Pitcher Plant and the Boronia are about to be classified as Class A., under the Permanent Reserves Act.

A General Review.

Bringing the whole of the National Parks of Australia into one focus, as it were, and making broad comparisons, I find that, if by a National Park the predominant idea is that of *Recreation* or *Amusement*,—the playground aspect—no other State is

so happily situated in this respect as South Australia. Within little more than 30 minutes' train journey from the city one is brought within the precincts of the park at Belair, and in this reserve—insignificantly small as compared with those in New South Wales—(like a town allotment compared with a country section)—one is not only close to the heart of Nature in the midst of hills and dales, but with sufficient level ground to provide for cricket or football ovals, and tennis-courts, in profusion, swings, etc. The popular conception of a day's holiday—I suppose a tribute to the active temperament of the British race—is that it is not complete, no matter what the temperature may be, unless some active exercise is indulged in. Shall we ever arrive, I wonder, at that stage of barbarism or culture or æstheticism—as you may individually view it—such as those Japanese evince who go out into the country solely to admire the beautiful sight of a blossoming tree? There is certainly very much to admire at our National Park, the blossom of trees (wattle, for instance), the flowers of the shrubs and lowlier plants, the song of birds, and beauty of landscape. Possibly later generations will find that with the increasing strenuousness of business life a reposeful day amid the beauty of Nature may be more beneficial, more recreative in its proper sense, to the harassed man of toil than the most active of outdoor games in which he can indulge.

The only other park in which provision is made to any considerable extent for games is the National Park at Port Hacking, in New South Wales, and with the exception of boating, is of quite recent date. I see by the report for the year ending June 30, 1908, that 20 acres were cleared near the Loftus Railway Station (on the outskirts of the park) as a cricket and football oval, and in a letter, dated September 10, 1909, I am informed that provision has also been made for tennis and swimming, whilst a portion of the river has been enclosed for bathers.

If, however, we regard a National Park, not so much as a *playground*, but as a *means* of *preserving* the *natural features* of a *country*, as well as a sanctuary for native birds and animals, we in South Australia are much behind some other States. I have already referred to the number, variety, and tameness of animal and bird life in the Sydney National Park, and the danger of extermination of some species, unless some such protection is afforded. It was for this reason, chiefly, that we were so anxious to secure the reserve at Kangaroo Island. But, even if this be made, as we hope it will, a real sanctuary for our native flora and fauna, its distance from the city and consequent inaccessibility to the *multitude* will prevent the bulk of the people having the pleasure of viewing our birds and animals under approximately natural conditions, such as would be the case if the enclosure at Belair, for which we have long agitated, were an accomplished fact. The term "enclosure" may be liable to be misunderstood. It must not be considered as a small fenced area for animals, such as we see in the Zoological Gardens, but one of many acres in extent; in fact, much in the same proportion as the flying cage for birds at the Zoo is to the aviary of the average householder.

If we turn to botanical life, we here have so far done things in a somewhat microscopic way. We have two minute enclosures for native plants in the park, but notwithstanding the by-laws,

NATIONAL PARKS AND FAUNA AND FLORA RESERVES, 1910.

State.	Name of Park.	Where Situated.	Area in Acres.	Total Area each State.	If Fauna and Flora Protected.
New South Wales	National Park	Port Hacking	33,719		Yes
	Kuring-gai Chase ..	Hawkesbury River ...	35,300	69,019	Yes
Victoria	National Park	Wilson's Promontory ..	101,730		Yes
	Buffalo	Co. Delatite	25,980		Yes
	Tower Hill	Co Victoria	1,360		No
	Mallacoota Inlet ...	Co. Croajingolong	11,400		No
	Wingan Inlet	Co. Croajingolong	4,730		No
	Snake Island	Co. Buln Buln	11,500		Fauna
	Lake Wongan	Co. Karkarooc	9,600		Fauna
	Other Reserves .. .	(Totalling)	2,919	169,219	—
Queensland	Bunya Mountains ...	29 miles from Dalby ...	22,500		Largely
	Mill Stream Falls ...	17 miles from Herberton ...	270		Largely
	Fairy Bower	15 miles from Rockhampton	216		Largely
	Killarney	5 miles from Killarney ...	135		Largely
	Gladfield	27 miles from Warwick ...	3,100		Largely
	Tambourine	37 miles from Brisbane ...	324	26,545	Largely
South Australia ...	National Park	Belair	2,000		Yes
	Kangaroo Island Reserve, or Flinders Chase ...	Kangaroo Island	93,440	95,440	Fauna and Flora
Western Australia Parks	King's Park	Perth	1,018		Yes
	National Park	Swan View	3,420	4,438	Partially
Fauna and Flora Reserves	—	Gledlow, near Albany ...	9		Pitcher Plant
		Plantagenet	10		Pitcher Plant
		Barrow Island	50,000		Fauna and Flora
		Near Mt. Barker	100		Boronia
		Murray	160,000	210,119	Fauna and Flora
Tasmania	National Park	Mt. Wellington	950		Yes
	Schouten Reserve ...	East Coast	15,000	15,950	Yes

flowers may seemingly be taken at random from the rest of the estate. At Sydney (Port Hacking) the trustees have reluctantly been compelled to prohibit the taking of *any wild flowers* at all, so much was the privilege of gathering a few of them abused. I think we shall have to go, also, for total prohibition at Belair.

In regard to native flora, I think Western Australia is most to be commended, for I have already given you particulars of the special reservations they have made for this purpose. No other State seems so much alive to the necessity for protecting the unique Australian flora, although Wilson's Promontory, Victoria, is a valuable reserve for such purpose.

I do not find that in any of the parks of other States, except our own, are foreign trees planted, with the exception that in two or three recently formed avenues at the Port Hacking Park, exotics have been utilized. In reply to my enquiry, I am informed that the trees planted in these avenues include Tristanias, Pines, Camphor, Laurels, and Oaks. At Belair, in the opinion of some of our members, this planting of exotics is somewhat over done.

There is one aspect in which we may have cause to rejoice, and that is that our National Park is *vested in trustees*, and practically free, therefore, from Parliamentary interference. The National Parks at Port Hacking and Kuring-gai Chase are also vested in trustees, but these seem to be all, if we except an area of 1,360 acres at Tower Hill, in Victoria, which is vested in the Koroit Borough Council.

FOREST RESERVES.

On the subject of forests generally, I have already written in the earlier portion of this paper, and it is gratifying to observe the increased attention which is now being given to this question. In the month of October, 1909, the subject of afforestation was brought forward in the Legislative Council by the Hon. E. Lucas in a forcible and suggestive speech, which was commented on in the daily press, and on which leading articles were written. The information was incidentally obtained that this question was one of the planks in the Labour Party's platform.

Broadly speaking, the subject has two aspects, which may be termed the climatic and the economic. The first appeals to us from the effect of forests on the climate of a country, as well as from a scenic or æsthetic point of view. The second regards the trees rather from what they are worth in a commercial sense, especially as regards their value simply as timber. Of the latter we have ample attestation. Recently Mr. R. T. Baker, of Sydney, gave two lectures in Adelaide in which he afforded us some idea of the capabilities of Australian trees, notably, the Eucalypts, for a great variety of purposes as well as for various products such as turpentine, many oils, perfumes, and essences. One extract—phelandrene—was said to be invaluable in mining, while piperitone had been proved to be more valuable even than eucalyptol. Reverting to their quality as timber, an Adelaide resident just returned from America states that in California the red gum is used for making the most beautiful furniture, and much resembles the best mahogany.

Mr. Baker pointed out how much esteemed were the Australian timbers by the Americans. In California, he said, they

had large plantations of them, and some agriculturists had given up wheat-growing, and had substituted timber, while one enterprising American expected to have nearly a million trees in six or seven years' time, worth 10s. each. It must be remembered that trees in Australia grow much more rapidly than those in colder climates. For instance, it is said that gums 24 years old, equal in size and carry more wood than oaks 300 years old. I understand that eucalypts grow even quicker in California than they do in their native land. Over thirty species of eucalyptus could be named, which are useful for such purposes as railway sleepers, bridge work, fencing, flooring, piles, poles, wood-paving, spokes, felloes, naves, girders, tool-handles, planes, house-building, rafters, etc. Suffice it to mention ironbark, box, red gum, jarrah, and karri. Then for flooring, ceiling, packing-cases, butter boxes, and interior work, we have various pines, such as hoop, brown, Cypress, and Murray pine. For furniture and cabinet work there are the finer-grained timbers of rosewood, red bean, white beech, silky oak, tulip wood, blackwood, satinwood, and sandalwood.

Before proceeding further, let me give some idea of how Australia stands in comparison with other countries in regard to forests. From a table in "The Official Year-Book of the Commonwealth," it seems that out of 19 selected countries there are only three which have less forest area than Australia, *viz.*, Cape of Good Hope, Algeria, and the United Kingdom.

Following are the figures for some of the representative countries, showing the relative area of forest lands:—

Cape of Good Hope	0·19
Algeria	3·17
United Kingdom	3·96
Australia	5·36
British India	10·83
France	15·65
Japan	18·98
Norway	21·13
Canada	22·23
Germany	25·90
New Zealand	29·83
United States	33·67
Russia in Europe	43·04

Now, with our 5 per cent. forest area, how much is specially reserved for timber? In the table which first came under my notice, this proportion was given as 0·81 per cent., but I find that owing to the total forest area in Western Australia being now reserved, the figures in the latest report are increased to 1·90 per cent. For the purpose of illustration, let us take a familiar one in money values. Suppose all Australia to be represented by £1; then the proportion of forest area is not quite equal to 1s. 1d., while a sum of about 5d. represents the specially reserved area of forests. (See table, page 305)

Of course, some States are more favoured by Nature than others in the way of forest endowment. For instance, while South Australia has only 3,840,000 acres, Queensland has over 40,000,000 acres. These are the extremes in the Commonwealth.

How are we using the talents entrusted to us in this matter? In other words, how much of what we have are we setting aside for

forests? New South Wales has only half the area of Queensland, but she has nearly double the reserves of the latter, while Victoria, with rather more than quarter of the area of Queensland, also exceeds that State in regard to the number of acres specially reserved. Of our own modest less than 4,000,000 acres of forest area, only *163,478 acres* are reserved. Of all the States, Victoria has the largest proportion of her forest area reserved, *viz.*, over one-third (⅓), while South Australia is lowest, with about one twenty-fourth (1-24).

We hear a good deal nowadays about afforestation. Now, this is excellent as a remedial measure, but prevention is always regarded as preferable to cure. The Queensland director forcibly presents this aspect in his report. He says, "The cutting down of the natural forests and the attempt to replace them by *artificial* plantations appears to have some hold on the popular mind. Anyone who visits the scrubs around Atherton may see the most splendid timber lying on the ground waiting to be burnt off; at least, that was the condition of affairs when I was last there, upon which occasion I reported in calm earnest that I had seen lying—*waiting for a fire*—timber, which, at any seaport in Australia, would be cheap at £1,000,000. Yet, close by may be seen 5,000 small *planted cedars*, growing along 40 miles of cleared bush track." He then goes on to show from answers to questions he submitted to the Lands Department, Sydney, that, after an experience of cedar-planting in a desultory way for over 20 years, there is really nothing to show of a practical character for a very considerable outlay. "Planting," he says, "appeals to the popular imagination, and I, too, am a friend of planting, but it must be systematic, on a fairly large scale, and well-protected, or it will turn out a failure. I hardly think that persons who talk so airily about planting slowly-maturing trees to supply the needs of persons who will live 100 *years from now*, realize that in our own time we are sure to reap the harvest of present neglect."

And here is a bit of prophecy that should arouse attention. "In fifty years," says Mr. MacMahon, "probably there will be no pine in Queensland, save in pleasure grounds, cedar will be a memory, and hardwood of the present quality and dimensions will be unobtainable. The great Forest Department, which will then exist, will be engaged in striving at great expense to *afforest* land which should never have been disafforested, and in buying back land which never was fit for any other purpose than forestry."

This writer's opinion is that it is much preferable to re-establish *natural* forests (*i.e.*, these forest areas which have been partially denuded) than to plant fresh forests elsewhere. I judge from the reports of our Conservator of Forests that in South Australia we have been more successful in our planting—as, for example, the pines and sugar gums, etc., at Wirrabara—than they in New South Wales and Queensland.

It has been asserted that Forest Conservation in the Commonwealth is in a most unsatisfactory condition, and that the great difficulty appears to be in the increasing demand that many of the richer forest lands be utilized for purposes of closer settlement. The real value of forestry as a source of national wealth appears to be very imperfectly understood in the Commonwealth. With a proper system of conservation the

Australian forests might be made to contribute largely to the public revenue without unduly interfering with the progress of settlement.

Whoever may be responsible for the unsatisfactory position or imperfect knowledge said to exist in the Commonwealth, the blame cannot be laid at the doors of the official heads of the various Forest Departments. I have quoted from the Brisbane Director, and now turn to Victoria. In 1905 and 1906 Mr. A. W. Crooke was the Acting Conservator of Forests in Victoria, and plainer speaking than he gives us can hardly be desired. In his 1905 report he says, on the subject of alienation of forest lands:—"In my last report I put my views on this matter plainly and fully. Suffice it now to say, that the question is one of the gravest importance to the whole State, and that in my opinion the time has arrived when we cannot afford to alienate *one acre* further containing valuable timber. At the very least 10 per cent. of a country should be covered with permanent forest. We have nothing like this. [S.A. much less.—W. H. S.] If any further lands are alienated, those who follow us must inevitably pay the piper, and bless the present generation when doing so."

Our own Conservator (Mr. W. Gill), in his report for 1908-9, says:—"The constant demand for timber in all the States is rapidly decimating the forest resources on this continent. The mature timber will soon be exhausted, and when once that is gone, there will be no dodging the consequence. The question how soon can *young* timber be used *must be faced*. I feel it my duty in the face of the astonishing rapidity with which timber is everywhere disappearing, to sound a warning note as to the imperative necessity for finding an answer to the question—What shall we do when all our mature timber is gone?"

I may mention that in the same report it is stated that during the year over 9,000 acres ceased to be forest lands, having been let on perpetual leases, and on agreement with covenant to purchase.

If we look at the value of timber imported into Australia, and especially study the rapid increase in the amount for the last two or three years, we must be struck with the significance of the figures. According to the report of the Queensland Director of Forests, the importation of foreign timber into Australia during the years 1906, 1907, and 1908, was as follows:—

Imported by.	1906.	1907.	1908.
	£	£	£
Victoria	563,310	628,886	735,353
New South Wales	526,413	652,317	710,973
South Australia	142,834	228,549	391,698
Western Australia	69,678	89,587	62,764
Tasmania	23,959	22,427	34,262
Queensland	3,262	10,727	10,028
Total Commonwealth (1)	£1,329,456	£1,632,493	£1,945,078

(1) These totals for the Commonwealth agree with those in the "Official Year Book" as regards 1906 and 1907, but in that publication the total value for 1908 is set down as £1,886,302. The difference, £58,776, is accounted for by the fact that certain items, chiefly picture and room mouldings, shafts, poles, and bars, hubs, and veneers, are not included in the "Official Year Book" returns.

South Australia is highest on the list, if the value is apportioned per head of population in 1908, *viz.*, 19s. 7d., while Queensland is the lowest, with 4½d. It is remarked that the imports are increasing at the rate of about one-third of a million pounds annually. The *per capita* importation for the whole Commonwealth is nearly as much as that for the United Kingdom.

It may not be uninteresting to note here that the exports of timber from the Commonwealth for 1908 totalled in value £1,039,114 of which Western Australia heads the list with over £640,000 worth, while South Australia is at the other end with *nil*.

The political economist might find food for reflection in the fact that more than nine-tenths of the value of timber exported by Australia in 1908 was for *undressed* timber, while of the timber imported from Norway, about six-sevenths of the total value was for *dressed* timber. On the other hand, it is noticed that the great bulk of the importation from the United States and New Zealand is for undressed timber. Taking the imports and exports from *all sources* during 1908 we find that we received into the Commonwealth dressed timber to the value of £324,997, and exported only £7,438 worth. During the same year, the value of undressed timber imported was £1,388,224, while that exported amounted to £389,024. One is inclined to ask whether a much larger proportion of timber exported could not have been *dressed*, and so give greater employment to Australians. In fact, one writer expresses the opinion that in one year a sum of nearly £2,000,000 was lost to the industrial classes of the Commonwealth, that amount representing the value of labour on the timber in the country whence it was exported.

An eloquent commentary on the rapid rate at which our forests are being denuded is supplied in the figures showing the quantity of local timber sawn or hewn in the Commonwealth. In 1907 the total was (2) 673,418,000 super. feet, and in 1908 it amounted to 483,449,000 super. feet. In the latter year Western Australia headed the list with 165,766,000 super. feet, New South Wales coming next with 122,150,000 feet, while South Australia was lowest with 436,000 feet; but, of course, from our point of view this last-mentioned fact is rather a matter for congratulation. Similarly the revenue earned by the Forests Departments will be regarded from varying standpoints. Suffice it just to mention that for the year 1907-8 the total for all the States Departments was £125,112, and in 1908-9 £156,937, New South Wales in each year having the highest and South Australia the lowest amount of revenue

Probably the expenditure on the Forests Departments will provide a more satisfactory method of gauging the opinion held by the various Governments as to the importance or otherwise in which the forests' question is viewed. More especially is this so if the expenditure is incurred in the effort to reafforest the country.

(2) If the figures quoted are correct, there was more than three times the quantity sawn, etc., in New South Wales in 1907 than in the four preceding years. In the following year the figures returned to the more normal quantity. This accounts for the reduction in the total of 1908, as compared with the previous year.

I therefore give below a table showing the expenditure in each State for the last two years:—

EXPENDITURE.

	1907-8	1908-9
	£	£
New South Wales ..	19,545	20,169
Victoria	18,754	27,066
South Australia	7,542	10,171
Queensland	6,940	4,652
Western Australia .	6,271	8,755
Tasmania	424	1,492
Commonwealth	59,476	72,305

It will be seen that in each State, except Queensland, there has been an increase in the last year's expenditure, and that the most marked increase is in Victoria.

I shall now give a brief summary of the information received in regard to each State in response to the questions submitted by me.

NEW SOUTH WALES.

The total area of forest reserves is 7,474,260 acres, of which 100 acres are enclosed for planting operations. They are now under control of the State, and are alienable, but the new Forest Bill proposes to make provision for the establishment of State forests.(3) The total number of trees planted last year (1908-9) is not available. The total revenue for that year was £57,592. Trees are distributed free to the public, 83,585 being given away during the year.

Exotics are not planted in the forests. The supply of growing timber is diminishing, but the extent cannot be stated. It is anticipated that much benefit will accrue from a reformed management of the forest reserves under the provisions of an Act which came into operation on January 1, 1910.

VICTORIA.

The total forest area is something over 4,000,000 acres, and 10,000 acres are enclosed for planting. The reserves are under the sole control of the State Forests Department. Portions of the reserves are licensed—and under the Forests Act, 1907, can be leased—to individuals and companies for timber-cutting. The area cannot be stated with exactness. The total number of trees planted during the year was about 200,000, and the total revenue for the same period was £41,929. In addition to indigenous trees, pines are planted largely in the reserves. Trees to the number of 28,284 were distributed to 1,910 applicants. The question as to the supply of timber increasing or diminishing cannot be answered with any degree of confidence.

QUEENSLAND.

The timber reserves, which total 3,019,919 acres, are temporarily reserved and are alienable, parts of them being opened for selection from time to time when not considered necessary for timber reservation.

(3) Reserves are not leased to private individuals or companies for timber-cutting, but are operated on under licences.

Quite considerable areas of the reserves are leased to private persons temporarily for timber-cutting and grazing.

Timber-planting has not hitherto been a feature of the work in this State, about 500 acres being more or less planted with Red Cedar.

The total revenue for timber for the year 1908 amounted to £27,969. Trees are not distributed to the public free. It is impossible to say to what extent the supply of growing timber is decreasing in the State annually, but there can be no doubt that like in all other Australian States the quantity growing is diminishing.

In addition to the timber reserves above referred to, there are 808,497 acres of "State Forests" in Queensland. These lands are unalienable except under the authority of an Act of Parliament, and are proclaimed under "The State Forests and National Parks Act of 1906." They are distributed over seventeen districts, the two largest being at Dalby (308,900 acres) and Maryborough (240,000 acres). In the former the chief trees are Ironbark, Spotted Gum and Cypress Pine, and in the latter Turpentine Blackbutt, Red Stringybark, and Tallowwood; the soil in both districts being mostly sandy to loamy.

South Australia.

The total area of forest reserves was, on June 30, 1909, 157,066 acres, of which 14,710 acres were enclosed for planting operations. The reserves are under the control of the State. Only such lands as are unsuited for forest purposes are now alienable, the rest are scheduled and are inalienable, save by vote of both Houses of Parliament.

The reserves are not leased to private individuals, but timber-cutting is permitted under various regulations. The total number of trees planted during the year was 116,088, and the year's revenue was £3,416. The only exotics planted in the reserves are pines, which are grown with very satisfactory results. Trees to the number of 277,616 were distributed during the year to 1,680 applicants. The supply of growing timber is diminishing. The dedication of further land for forest reserves is contemplated on the expiration of some existing Miscellaneous Leases.

Western Australia.

The total area of forest reserves is officially given to me as 10,366,737 acres, although in the latest Official Year Book of the Commonwealth it is shown as 20,400,000 acres, which are also the figures for the "Total Forest Area" of the State, and a footnote remarks that the "Total Forest Area is reserved."

The area enclosed for planting operations consists of 640 acres at Ludlow and 200 at Hamel. All reserves are held by the Government, and timber-cutting is allowed under restricted conditions. There were 68,000 trees planted during 1909, and the total revenue for the year, ended June 30, 1909, was £29,484.

Tasmania.

There are thirty-five forest reserves, totalling 283,954 acres; 166,954 acres contain mature timber and 117,000 are reserved for the growth of young timber. A commencement has only recently been made to enclose areas for planting operations. The reserves are under the control of the State, and the land is available for selection after the timber has been removed.

There are 96,547 acres leased for cutting timber. No trees were planted during the year. No exotics are planted. Free distribution of trees is contemplated in the near future. The supply of growing timber is diminishing. It is added that "there are large areas of forest that have not been reserved, as they are not at present accessible."

One great cause for the destruction of some of our finest gum trees is for their conversion into sleepers. I suppose that most of the magnificent trees that have been cut down in Clarendon, Blumberg, and Mount Crawford districts have been for this purpose. Mr. Lucas, in his address, to which I have referred, remarked that we were "getting near the end of our tether"; and we are now importing sleepers very largely from Western Australia. One is inclined to the opinion that if some suitable substitute for timber sleepers could be found, the remaining monarchs of our wood might still be spared. I understand that steel sleepers are being somewhat largely used or experimented with, but I am also informed that exhaustive trials in America have demonstrated that the timber sleepers are the only satisfactory kind. In fact, a little over two years ago, one of the largest American railway companies sent its timber expert to Australia to study the culture of our various gums with a view to their being grown in his own country for sleepers. He stated that his company was setting aside the very best land obtainable for this purpose. Our own Conservator tells me that locally-planted Red Gum is not of sufficient age for sleeper-cutting, although we in this State led the way in planting operations. If, therefore, our mature timber is largely exhausted, and many years may elapse before the locally planted is old enough, there seemingly must come a time when there will be a gap in the supply, unless one of two things happens—either a suitable substitute be found for timber sleepers, or some artificial treatment of younger wood be discovered to make it as equally serviceable as the naturally-mature timber.

It is satisfactory to notice that in the last few years the Australian States' Governments seem to be awakening to the need for more attention being paid to the general question of forestry. Two or three years ago a Royal Commission was appointed in New South Wales to enquire into the question of the timber supply of that State, and sat for fifteen months. In addition to the 7,000,000 acres reserved for forestry purposes, the Commission recommended considerable extensions. In Queensland the State Forests and National Parks Act was assented to on December 14, 1906. In Victoria a new Act (Forests Act) was passed in 1907, while in our own State increased grants have been promised by the Government, and just recently an Instructor in Forestry has been appointed.

There is but one more aspect of the question to which I shall allude. I may call it the moral aspect. Here in Australia the native-born (and the rising generation especially) have been charged with lack of reverence. We have no ancient piles of stone replete with historical interest—the memorial of our country's past; no venerable cathedrals or ruined castles or moss-covered towers. Our highest mountain (Mount Lofty) is but a dwarf compared with its one-time greatness; the waters of our Gulf, which Lord Tennyson says are "barred with purple and gold and dazzling sunlight," beat on our shores in the same rhythmic measure—perchance not higher nor lower than ages since; our

"noble River Torrens" was doubtless nobler still in bygone days; our kangaroo and wombat are but pigmies compared with their ancestor, the Diprotodon; but our gum-trees year by year raise their heads higher and higher and spread their limbs still further afield. The most casual observer can hardly fail to be impressed—their age is self-evident. He must, if he but reflect a moment, realize that before he was born, before his grandparents or *their* grandparents saw the light of day these noble trees were unfolding their mighty limbs and giving shade and shelter to the black-skinned savage; and surely as he looks he must admire, and with that admiration must surely be mingled some element of reverence—that reverence which age should always inspire. Yes, though our country is old it requires the seeing eye to learn this from its rocks, and so, it seems to me, it is left for the giant gums to proclaim in unmistakable clearness that they represent in concrete form the growth of hundreds of years. Alas! that in one short day that which has been the work of centuries may be levelled to the ground.

To sum up the whole question, I take this to be, briefly, the position in regard to our forests:—

1. Compared with many other countries Nature has been niggard in the provision of forests for Australia generally, and South Australia in particular.

2. Notwithstanding our modest inheritance, we have acted the part of the spendthrift by cutting, ring-barking, and burning some of our best forest country.

3. That the supply of timber for industrial purposes is everywhere diminishing, and must, unless counteracted, cause serious consequences in the not-distant future.

4. That our eucalypts, on account of the quality of their timber, offer special inducements for their destruction.

5. That the value of their oils and extracts is but yet only imperfectly understood.

6. That other nations—the American in particular—recognize, if *we* do not, their many good qualities, and are cultivating them with great success.

7. That in view of the foregoing we should:—

(a) Strictly preserve existing forest areas.

(b) Increase them wherever practicable.

(c) Reafforest by natural means partially denuded areas.

(d) The State should spend large sums in artificial afforestation by planting on a large scale, not only in (as at present) somewhat poor soil, but on rich land, so as to secure the best results.

(e) Encourage Local Governing bodies and private individuals to plant forest trees. In one State such encouragement is given by providing that no extra rate is to be levied on account of the increased value of land placed under forest cultivation.

(f) And, lastly, that we should have in view the commercial aspect as well, so that when we shall have enough and to spare (and, until then, by judicious thinning) we shall estimate our native timbers at their proper worth, and see them used for those multifarious purposes which a civilized community requires; and having satisfied our own needs, send the surplus to other parts, to our profit, to their enjoyment, and to the mutual satisfaction of all.

The subjoined table, "Forest Reserves and Forest Areas, States and Commonwealth, 1908," taken from the latest issue of the "Official Year Book of the Commonwealth" (published in 1910), is reprinted as it there appears, with the exception that the "area specially reserved for timber" in Western Australia has been corrected, in accordance with official information recently supplied by that State. The percentages of such Reserves to the State and Commonwealth area have also been altered to meet that correction :—

Forest Reserves and Forest Areas, States and Commonwealth, 1908.

State.	Specially Reserved for Timber	Total Forest Area	Percentage of State Area.		Percentage of Commonwealth Area.	
			Specially Reserved.	Total Forest.	Specially Reserved.	Total Forest.
	Acres.	Acres	%	%	%	%
New South Wales	7,474,260	15,000,000	3·76	7·67	0·39	0·72
Victoria	4,009,616	11,797,000	7·13	20·97	0·21	0·62
Queensland ..	3,836,191	40,000,000	0·89	9·32	0·20	2·10
South Australia ...	157,066	3,840,000	0·03	0·66	0·01	0·20
Western Australia	10,366,737	20,400,000	1·66	3·27	0·54	1·07
Tasmania .. .	283,954	11,000,000	1·70	65·56	0·01	0·58
Commonwealth	26,127,824	102,037,000	—	—	1·36	5·29

Table showing Area of Forest Reserves and Area enclosed for Planting, 1909.

Date of official letter.	State.	Area of Forest Reserves.	Area enclosed for planting.
		Acres.	Acres.
15 September 1909	New South Wales ..	7,474,260	100
28 July 1910	Victoria	(Over) 4,000,000	10,000
24 December 1909	Queensland	3,019,919	500
9 September 1909	South Australia	157,066	14,710
22 November 1909	Western Australia ..	10,366,737	840
2 September 1909	Tasmania	283,954	* —
	Total, Commonwealth	25,301,936	26,150

* State Nursery work only recently been undertaken.

MALACOLOGICAL SECTION

OF THE

Royal Society of South Australia (Incorporated).

ANNUAL REPORT FOR THE YEAR 1909-10.

Eleven meetings were held during the past year, at which the average attendance was six. There are now thirteen members. The Section regrets the resignation of Miss Stow from the roll of membership. The chief work of the year comprised a revision of the *Pleurotomidæ*, *Dentalium*, and *Pyrene*.

Papers were contributed to the Royal Society by Dr. J. C. Verco on the following subjects:—"Notes on South Australian Marine Mollusca, Parts XI. and XII."; "On the *Triphoridæ* of South Australia"; "The *Pleurotomidæ* of South Australia"; and "The *Brachiopoda* of South Australia."

F. R. Zietz, *Hon. Sec. and Treasurer.*

Receipts and Expenditure for the Year 1909-10.

Receipts.

	£	s.	d.
To Credit Balance	0	1	11
,, Grant from Royal Society	1	0	0
,, Subscriptions	2	5	0
	£3	6	11

Expenditure.

	£	s.	d.
By Postages	0	8	1
,, By Subscriptions to Royal Society ...	2	5	0
,, Balance in hand	0	13	10
	£3	6	11

F. R. Zietz, *Hon. Sec. and Treas.*

MICROSCOPICAL SECTION

OF THE

Royal Society of South Australia (Incorporated).

ANNUAL REPORT FOR THE YEAR 1909-10.

OFFICERS.—*Chairman*, Mr. W. Fuller; *Vice-Chairman*, Mr. W. B. Poole; *Hon. Secretary*, Mr. H. W. H. Hale; *Committee*, Messrs. D. Gordon, B. S. Roach, and E. J. Bradley; *Auditors*, Messrs. A. G. Rendall and H. Whitbread.

Your Committee has to report that the seventh session of this Section of the Royal Society of South Australia has shown continued interest on the part of its members in general microscopy. The attendance at the meetings has improved, averaging seventeen, and a considerable increase in the membership has been made.

During the year papers and work of much interest have been contributed by members, excursions for the purpose of collecting natural history objects of interest have been made. An event of the year was an address delivered by Prof. T. Brailsford Robertson, D.Sc., Ph.D., etc., of the University of California, which was rendered additionally interesting by the fact that Prof. Robertson had in his younger days received much stimulus in the direction of his biological studies from one of the founders of this Section, the late Mr. Smeaton.

SYNOPSIS OF MEETINGS HELD.

September 28, 1909.—Annual General Meeting. Paper by Mr. C. Quinn upon "The Potato Blight, *Phytophora infestans*," illustrated by specimens, mounts, and drawings; exhibition of Photo Micrographs by means of the Zeiss apparatus, by Mr. W. B. Poole; and an exhibition of instruments.

October 22.—Excursion to Happy Valley.

October 26.—Exhibition of various natural objects collected during the excursion to Happy Valley. The Chairman announced that Mr. Hale had presented the Section with a copy of Dr. Van Heurck's "Treatise upon the *Diatomaceæ*." Exhibits were made by Mr. W. H. Baker of mounts of *Crustaceæ*, illustrative of their life history; and by Mr. Hale of a variety of Diatoms, and of the *Trypanosoma Lewisi*, mounts of which were made from the blood of rats taken in Adelaide.

November 10.—The meeting of this date was held at the laboratory of Veterinary-Surgeon Desmond, Government Bacteriologist, who had kindly invited members to view his equipment and working methods. Bacteriological and pathological work was explained, methods of sectioning and mounting, especially in connection with practical and rapid examinations of suspected materials, and a most valuable evening spent.

March 22, 1910.—Address by Mr. E. J. Bradley upon "The Microscopic Natural Objects to be found in the vicinity of Pekina Creek, especially in relation to the Parasitic Life to be found upon the Fauna of the District."

April 26.—Exhibits and discussion. Specimens of the Hydroid *Sertularia elongata*, sent in by Mr. Edquist. Biological specimens of interest exhibited by Mr. E. P. Stanton, and of a choice collection of Diatoms, mounted by Mr. H. Leonard, of the Royal Microscopical Society, shown by Mr. Bradley.

May 24.—Exhibition of microscopic natural objects by various members.

June 28.—Address upon "The Chemical Fertilization of Animal Eggs," by Professor T. Brailsford Robertson, D.Sc., Ph.D., of the University of California, Berkely, Cal., U.S.A. This address will be published in the Trans. Roy. Soc., South Australia, in connection with the Section's report.

July 26.—Exhibition of instruments; one of especial note exhibited by the Chairman (Mr. W. Fuller), built by Zeiss, of Jena, to specifications sent, for metallurgical and petrographical work. A collection of Diatoms exhibited by Mr. D. Gordon, mounted by Mr. Jas. Wedeles, of Melbourne.

August 23.—Paper by Mr. W. B. Poole upon "Nematode Worms," dealing in particular with *Tylenchus tritici*. This parasite, the especial cause of the "peppercorn" disease of

wheat, was shown both living and mounted, and the address was further illustrated by excellent mounts and specimens of Nematoda in general.

W. FULLER, *Chairman.*
H. W. H. HALE, *Hon. Secretary.*

RECEIPTS AND EXPENDITURE FOR THE YEAR 1909-10.

Receipts.

	£	s.	d.
To Subscriptions	4	17	6
,, Grant, Royal Society	12	10	0
,, Dr. Balance	0	5	9
	£17	13	3

Expenditure.

	£	s.	d.
By Stationery	1	0	0
,, Printing and Postage . ..	2	19	0
,, Advertising	1	11	8
,, Use of Lecture-room	0	12	6
,, Balance from 1908-9	0	2	7
,, Subscriptions to Royal Society . ..	11	7	6
	£17	13	3

Audited and found correct with vouchers { H. WHITBREAD. ALEX. G. RENDALL.

RECENT EXPERIMENTS IN THE CHEMICAL FERTILIZATION OF ANIMAL EGGS.

A Lecture delivered by T. Brailsford Robertson, Ph.D., D.Sc. (Associate-Professor of Physiological Chemistry and Pharmacology, University of California), before the Microscopical Section of the Royal Society of South Australia, at Adelaide, on Tuesday, June 28, 1910.

During the past five years it has been my great privilege to be associated with one of those men of whom a very few occur in every generation, to whom it is given to lay the foundation-stones of a newer and greater and more gracious civilization, to furnish us with the instruments for eliminating some of the hard and ugly things of life, and to bend the forces of Nature more fully to our service. Such men are the Galileos, the Newtons, the Faradays, and the Darwins of their age, and such a man is my friend and former chief, Professor Jacques Loeb, formerly of the University of California, now of the Rockefeller Institute, New York. It is not often or to many that the opportunity occurs of being in the position of those who stood upon a peak in the Darien and gazed with wild surmise upon the vast and hitherto unsuspected realms which lay before them. We who have been associated with Professor Loeb in the last few years have seen unfolded to our view territories of scientific discovery, far more fraught with import for our human welfare than even that great sea upon which the discoverers of an earlier day gazed with such prophetic awe. Perhaps it is not too much to say that all that has gone before of human achievement pales into insignificance beside that of penetrating the obscurity which has hitherto enshrouded the most fundamental things of which we know, life, and growth, and death.

It is my privilege to-night to lead you a little way into these new territories of fact and to help you to realize, however imperfectly, the vast significance which they may come to have in your lives, and which they will certainly have in the lives of those who follow after. Perhaps the most fundamental phenomenon which living material presents is that of growth. No matter how special the function of a living cell may be, it invariably possesses the capacity for growth, and its functional activity is accompanied by growth. A muscle cell atrophies when not used, and by exercise it grows. Even a cell of such special functions as a nerve cell, which has to perform the extremely special function of conducting nervous impulses, has the power of growth, and of that discontinuous growth which we call reproduction. It therefore occurred to Professor Loeb that the most fundamental phenomena he could study were those of growth, and of discontinuous growth—reproduction—and he accepted the task of analysing the phenomena and the processes which underlie them. This stupendous task was undertaken by him only 12 years ago, and at this present date we are in a position to say definitely that at such and such a stage in the development of an embryo the chemical processes which occur are definitely of such and such a nature—a position which is astoundingly far in advance of that almost complete

ignorance in which we were involved before this research was undertaken.

As in all biological investigations, it was necessary first of all to find an organism or a cell which displayed in the most advantageous manner the phenomena it was desired to investigate. For this purpose such a cell was found in the egg of the sea-urchin—a familiar organism, the shells of which are often observed on the beach after a storm, and are colloquially named sea-eggs. The egg of the sea-urchin presents many advantages. In the first place it has a comparatively large cell. It may readily be seen, and appears of a large size under the low powers of a microscope and all of the mechanical phenomena occurring in it may easily be observed and followed by the eye with such means. The spherical cell has a very small nucleus which can hardly be detected except by special methods of staining and examination. These eggs are produced by a single female sea-urchin in millions, and it is therefore possible to perform no less than a million simultaneous experiments by simply taking the eggs from one female.

The spermatozoon, or male element of the sea-urchin, is a very different type of cell. It is extremely small, and almost entirely consists of nucleus. The normal fertilization of the sea urchin egg takes place in the following manner. The eggs are discharged into the sea by the female, and the spermatozoa are also discharged into the sea. The two meet by accident Only a very small proportion of the eggs become fertilized, and from the fertilized eggs a sea-urchin embyro results. From the embyro which is a free-swimming organism—swimming by means of cilia, or little hairs on the exterior surface, which propel the animal through the water—the complete development into a fully grown sea urchin is a matter of some two years. You will, therefore, readily imagine that it is quite possible to fertilize the eggs normally in the laboratory in a glass container, and watch the processes going on. You only have to take some eggs out of the female, and some spermatozoa from the male, and mix the two together in sea water. We then observe the following phenomena. The spermatozoa will be seen crowding around the egg. The spermatozoa can swim freely by means of little hairs which they possess at their posterior extremity. Hundreds of these will be seen surrounding one single egg. One spermatozoon enters the egg. In doing so it seems to cleave a sort of passage through the egg, leaving a distinct trail behind. Almost the instant that it enters the egg a peculiar appearance is observed. The egg itself is rather granular and opaque, but immediately after fertilization a small clear area begins to appear on the outside, which gradually increases in width until we have the appearance of a granular sphere enveloped in a clear transparent shell. This clear area is surrounded by a membrane which pushes out the spermatozoa and prevents any more from entering, so that, as a general rule and under normal conditions, only one spermatozoon enters the egg. The instant the spermatozoon enters the egg the formation of the clear membrane prevents the entrance of any more spermatozoa.

The events which succeed this are, so far as physical manifestation goes, very obscure and difficult to follow by the eye, but of one event we may be perfectly certain—that the nucleus of the spermatozoon and of the egg come together and fuse into one nucleus. A point which it is rather important to recollect is that the spermatozoon consists almost entirely of nucleus. Therefore,

until we find evidence to the contrary, we may consider that the nucleus of the spermatozoon is the most important part of it. In spite of this fact, however, it has been proved that a fusion of these two nuclei is not absolutely necessary for fertilization, although it occurs normally. It is possible, as shown by Boveri, to cut a piece of the spherical egg, not containing any of the nucleus, and to fertilize that by means of spermatozoa, and to obtain an embryo.

Although the visible mechanical phenomena which succeed fertilization are very difficult to follow, the chemical phenomena, thanks to the investigation of Loeb, are now rather well understood. The chemical process which unquestionably follows the fertilization of an egg is primarily an oxidation—a combustion, or burning up of some material. In all combustions oxygen is used up—oxygen derived from the air—and oxygen is used up in the development of the sea-urchin's egg. Normally, after the stage which I have described has been reached, after a pause of greater or less length the egg within the clear surrounding membrane divides into two. The nucleus also divides into two, and we have two nuclei. Following this, each cell divides into two, and this process of division continues until we have a sort of mulberry-shaped object lying within this clear membrane. As development proceeds, thousands of cells are produced by this single original cell until a sort of sac is produced, and finally this sac breaks through the clear membrane, and develops into a pyramid-shaped embryo, with a perfectly defined skeleton in it, and with swimming cilia on the outside. All this can be readily followed with the eye under the microscope, but the whole process depends on the presence of oxygen in the waters in which it occurs. If we deprive the original cell of oxygen, by no means whatever can this development occur. We do not kill the cell by depriving it of oxygen, because after having done so for many hours, and completely arresting development thereby, on letting in oxygen again development goes ahead just as if it were normal.

Now, you recollect I told you that not only does the original cell divide into two after fertilization, but also the nucleus, and the strange part of it is that at the end of the division each of the nuclei is as large as the original one. Moreover, when the original cell has divided into four, each of the nuclei is as large as the original single nucleus. The same is true when we have 64 or any number of cells. The total number of cells, however, is not much larger than the original cell, because it all takes place within the membrane, which prevents the embryo from increasing in size in the early stages, but the quantity of nucleus material within the membrane is increased enormously. The material of the nucleus of the cell differs from most of the material occurring elsewhere in the cell by its very high content of phosphorus, and the question arises where does the phosphorus contained in these nuclei come from? In older days it was generally assumed that it came from the sea water, which does contain a little phosphorus in the form of phosphoric acid, but it is possible to carry out the entire process in artificial sea water made up in the laboratory which contains no phosphorus whatever, and the development occurs precisely as it does in sea water taken from the ocean. Therefore the phosphorus certainly does not come from the sea water. There is only one substance within the cell from which all that phosphorus can be derived, and that is a substance of a fatty nature known as lecithin. It can be very easily shown

from chemical considerations that if the lecithin is split up, and the phosphorus abstracted from it, a substance known as cholin must be set free.

Let us turn for a moment to another and apparently disconnected series of facts. If we take a drop of any oil, such as olive oil, and float it on the surface of pure water, the drop of oil, of course, does not mix with the water, but simply floats on the top. If we take a very fine cotton thread and soak it in cholin, which is a liquid, and then just touch the surface of this droplet with the thread, the droplet immediately divides into two. Understand, we are not cutting the droplet with this thread. If we tried to cut the oil with a thread, dry or wet with water, we should fail, but if we wet the thread with cholin and apply it to the oil the latter immediately splits into two, and we get two separate droplets floating on the water. The physical mechanism of this is perfectly well understood, but it involves certain rather abstruse principles upon which I shall not dwell to-night. Now, you recollect I told you that in the production of the nuclear material the only possible source of the phosphorus must be the lecithin existing within the cell, and that, in taking phosphorus from the lecithin, the nucleus must leave behind a quantity of cholin Let us suppose that the nucleus in this original cell is divided into two nuclei which migrate to the two opposite poles of the cell, and proceed to grow. They can only grow by taking the phosphorus away from the lecithin, and as they do that cholin must be set free. This cholin will immediately proceed to diffuse through the body of the cell as all substances in solution do. It will diffuse in all directions equally, but you will observe that it will diffuse towards the middle of the cell from two sources, whereas towards the outer edge of the cell it will diffuse from only one source, so that the middle of the cell is receiving two supplies of cholin, but on the outside it is receiving only one. The result is that the concentration of cholin within the cell must be greatest along the line lying equidistant from the two nuclei, and the cell divides into two just as the oil droplet divides into two, and for the same reason We therefore understand the mechanism of this rapid division into two more cells which occurs within this original cell, and we can imitate it artificially with such things as oil droplets at our will.

It has become possible during recent years to control these processes of cell division almost absolutely at our pleasure. Let us take the case of this original cell which has divided into two. If we wish, we can make those two cells melt into one again by the very simple method of adding to the sea water a little alkali, something of the nature of soda—washing soda. These two cells fuse into one when treated in that manner. What happens then? We get a giant embryo—double the normal size. We can do more than that. We can cause those two cells to fall apart entirely, and no longer adhere along their line of division. What happens? We obtain twins—two embryos, one developed from each cell. The method by which we can do this is very simple. Excluding a few substances existing in minute quantities, ordinary sea water consists practically of certain salts dissolved in water in the following proportions:—1,000 parts of chloride of sodium, which is ordinary table salt; 78 parts of chloride of magnesium; 38 parts of sulphate of magnesium; 22 parts of chloride of potash; and 10 parts of chloride of lime. It is easily proved by experiment that, for the normal fertilization and development of sea-urchin eggs,

the magnesium salts may be eliminated, and we may take up sea water containing 1,000 parts of sodium chloride, 22 parts of chloride of potash, and 10 parts of chloride of lime, and the sea urchins will develop in that perfectly normally. In order to produce twins by causing these two cells to fall apart, it is only necessary to eliminate any one of these constituents. Leave out the lime and the embryos which develop in that solution are always twins. Leave out the potash and you get the same result. Leave out the sodium and you get the same result.

Twins which are produced by mammalia, to which class of animals we ourselves belong, are always one of two kinds. They may be dissimilar twins which are easy to distinguish, and may be of different sexes. They are probably produced from two separate egg cells, but there is another class of twins about which the stories are always told of blue ribbon and red ribbon being used to distinguish them—twins who resemble each other most strikingly, and are always of the same sex. These twins are not improbably produced by the falling apart of the two first cells into which the egg cell divides. Probably there is a slight disturbance in the composition of the blood. The blood in the body, so far as the inorganic salts are concerned, approximates very closely to the composition of the sodium, potassium, and lime mixture which I have just described, and a slight disturbance might easily result in the falling apart of these two cells, and result in the production of identical twins.

Ten or twelve years ago Professor Loeb set himself the problem of artificially fertilizing the egg of some animal without the assistance of spermatozoa. In the search for this method it is unquestionable that he was guided by a principle which he has probably forgotten to-day. An hypothesis when it has led us to facts, and is no longer serviceable, is not worth remembering. One of the earliest things he tried was simply to increase the concentration of sea water. We can do that very easily in a variety of ways. We can evaporate it to a certain extent. Of course, if you go too far the salts crystallize out, but you can evaporate a little and still keep the salts in solution, or you can add to sea water a salt solution or a sugar solution of higher concentration than itself. When we have prepared such a sea water concentrated about 60 per cent., and placed in it sea-urchin eggs, the following phenomena occur. The egg is left in the concentrated water for something like two hours, and is then taken out and put into normal sea water. Within half an hour or so after that, the cell divides and so forth just as the normal fertilized eggs do, but it does not produce that clear membrane which is characteristic of normal fertilization. When the embryo is produced—a free-swimming embryo of pyramidal shape, which swims by means of cilia, and possesses a skeleton instead of swimming on the surface of the water like a normal embryo it swims at the bottom of the water. Obviously at that time Professor Loeb had not succeeded in completely imitating natural fertilization, but he had made a long stride towards doing so.

Let us analyse a little more fully this fertilization by increased concentration. It has been found by later experimentation that in this phenomenon two factors are concerned. One is the concentration of the sea water. At first it was imagined that this was the only factor, but we now know there is another, and that is the quantity of alkali in the sea water. Most sea water is very faintly alkaline, behaving as though it had a very slight

concentration of soda dissolved in it. If sea water contains no excess of alkali at all, this development will not occur. The alkali alone—soda alone—will not cause development unless the concentration is raised. Therefore we have two factors—concentration, and what we call alkalinity. The question arises "What is the significance of these two factors?" What part does each play in the result observed? That can now be very simply answered. All that the alkalinity of the sea water does is to accelerate the process. As we increase the quantity of alkali in the sea water the successive cell-divisions occur more rapidly. In the total absence of alkali they would probably occur some time, but perhaps not for centuries, and in the meantime bacteria would get in, and the cell in various ways would meet the fate which we believe to be the fate of all living material before there had been time for the first cell division to occur. In what way does the alkalinity increase the velocity of the cell divisions? It does so by accelerating the rate at which the combustions go on within the cell—oxidations. Oxygen is being used up by the cell during these divisions. When that is being used it means that something is being burnt up. When anything burns—a candle, a fire, or ourselves—oxygen is used up in the process. If we deprive the cell of oxygen, or diminish the amount of oxygen supplied to it, these divisions cannot take place in the presence of any quantity of alkali, or of any concentration of sea water. It is a familiar fact to the physiological chemist that alkali increases the velocity with which oxidations occur in animal fluids, and the function of the alkali in these processes is almost certainly that of accelerating the oxidations necessary for cell divisions. This factor of the alkalinity of sea water was overlooked in the first stages of the investigations, and from that many curious mistakes arose. In the first place Professor Loeb did these experiments at Wood's Holl, on the Atlantic coast. He was perfectly successful with thousands of them. Then when he came out to Pacific Grove, on the Pacific coast, he tried to repeat the experiments, and failed completely. At first he was very much puzzled and worried. It was only after a whole summer's investigation that he found that the Pacific Grove sea water was less alkaline than that of Wood's Holl. Whereas the latter water, concentrated, would cause artificial fertilization by itself, to the Pacific Grove water he had to add some alkali. That mistake has been repeated more recently in Plymouth, England, where they have failed for years to get Loeb's results. Dr. Loeb went across to Europe a year ago, and, passing through Plymouth, found them in this dilemma. He at once suggested the addition of a little alkali to the sea water, and immediately they were able to repeat all his experiments with complete success. This method of artificial fertilization was not completely successful in that it did not absolutely imitate natural fertilization. The clear membrane around the outside of the dividing cells which is characteristic of natural fertilization was not produced. It was not until 1905 that Professor Loeb succeeded in finding out how to do this artificially, and thus succeeded in imitating every feature of natural fertilization. Again a principle led him to the method he tried—a principle which was doubtless faulty, though it had its use, and probably has been discarded and forgotten. We don't know what it was. Sufficient it is that it led him to the truth. He found that if, before treating the sea-urchin's egg with con-

centrated sea water, he treated the egg with certain acids all belonging to a well-defined chemical group he got the formation of the clear membrane. The acids which he found he could use with success were the following:—carbonic acid, formic acid, acetic acid, propionic acid, and butyric acid. All these, except the first one, belong to a group known to chemists as monobasic fatty acids. There are a large number of others much rarer and not so well known.

The process in detail is this:—He takes a certain concentration of butyric acid in sea water. He adds two cubic centimetres of a very weak solution of butyric acid to 50 cubic centimetres of sea water, and places the unfertilized eggs of the sea urchin in this mixture for about two minutes. He then puts the eggs in concentrated sea water, 60 per cent., for from 40 to 60 minutes at ordinary temperatures. He next takes the eggs out of that and places them in normal sea water. Directly after they have been taken out of the butyric acid solution they form the clear membrane, but the cell does not yet begin to divide. He then places the eggs in concentrated sea water for 40 to 60 minutes, and next into the ordinary sea water, and in half an hour the cell begins to divide perfectly normally into 2, 4, 6, 8, 16, 32, and 64 cells, and so forth. The embryos formed by this artificial fertilization are perfectly normal. They form skeletons perfectly normally, they swim at the surface of the water normally; and, quite recently, they have been raised to the stage of adult sea-urchins by Delage, of Paris, to whom very great credit is due for the inexhaustible patience he exercised during the two whole years he was nursing these sea-urchins every day. When you realize that one of those almost microscopic embryos, about the size of a pin's head, has to be placed in about five gallons of sea water, supplied with air bubbling through it all the time, and with sterilized diatoms for its food daily, besides having to have the water changed daily, you may realize that some patience had to be expended over the problem of bringing up these fatherless urchins to the adult stage.

Let us follow the process of the membrane formation a little more closely—the formation of the clear white membrane around the egg cells. If we watch the sea-urchin eggs very closely during the first period following fertilization, whether natural or artificial, we observe the following phenomena. First of all we have a normal egg cell of a perfectly spherical, smooth outline, but during the first instants of fertilization sundry little blisters appear on the surface. Little globules float to the surface of the egg and raise a very fine membrane from the surface. These little globules are formed all over the surface of the egg. They get larger and larger until they encroach on each other, and finally fuse into one complete layer all round the egg. You may enquire what happens if this process is allowed to go on. In natural fertilization it does not go on. The clear membrane being once formed, the cell division starts, and the whole thing goes on normally, but by artificial fertilization we separate these two things. We make the membranes first and cause the cell division afterwards. If we let the egg go at the stage where the membrane is formed, and do not proceed any further, what happens? The egg very rapidly dies. It does not stop at this stage of forming globules on the surface and letting them run into one membrane, but forms globules all through, and finally falls apart and nothing is left. The cell is completely liquefied, or some constituent of

the cell necessary for its integrity is liquefied. What is this constituent? To attempt to answer that question Professor Loeb investigated a vast number of organic and inorganic substances to find which substances would cause the formation of this membrane. He wanted to find out whether any substances besides the monobasic fatty acids would cause the formation of the membrane, and he found a large number that did so. A few of them are—ether, chloroform, benzol, ordinary gasoline, and a large number of other substances. All these substances have only one property in common—that of dissolving fats. We know that the egg, and that all cells in fact, contain a certain quantity of fat, and it appears at least possible that the real significance of the formation of this membrane is that a layer of fat, or an emulsion of fat something like cod-liver oil emulsion, is liquefied at the surface of the egg by an agent which causes the formation of the membrane, and that the droplets of fat thus liquefied by solvents are run together to form the membrane.

In order to test this point we may compare the behaviour of these eggs with certain cells which occur in our own bodies, and which are almost exclusively composed of fatty materials—the red blood corpuscles. Anything which will liquefy them will also cause the artificial formation of a membrane in the egg. Among other things which will liquefy our red blood corpuscles are—the blood of any other species of animal, or extracts from the organs of any other species than our own. We are not peculiar in this respect, because the red blood corpuscles of any animal are liquefied by the blood or cell extracts of any species of animal other than its own. It therefore suggested itself as a possibility that the eggs of the sea-urchin might be fertilized, or at least that the fertilization membrane might be formed, by simply acting on them with the blood of another animal, and to a certain extent this was found to be true. If we act upon the eggs of the sea-urchin with ox blood or sheep's blood obtained at the slaughterhouse, or with the blood of the first animal experimented on—a worm—in fact, the blood of any sufficiently distant species of animal, it will cause a small percentage of eggs to form a membrane—not more than half a per cent., and then only very slowly, perhaps in half an hour or an hour. This was not at all satisfactory. Some method had to be found to accelerate it, and it was found. It was discovered that the eggs of the sea-urchin could be rendered sensitive to foreign bloods by special treatment. So far only one such method has been found, but others unquestionably will be found. This one is by acting on the eggs with the rather rare salt known as strontium chloride. If we act on the eggs with a weak solution of this substance for about two minutes, and then place them in sea water containing a mere trace of the blood of a foreign animal of another species, within two minutes nearly all of the eggs are fertilized. They will not be fertilized by the strontium chloride alone. Treat them only with that and the eggs simply die. Place them only in the blood and about half per cent. fertilize and develop. Place them first in the strontium chloride and then in the blood and nearly all will be fertilized and will develop.

These facts are connected with something very important to ourselves. The fact that our blood is capable of liquefying the cells of another animal shows that it contains substances which are capable of liquefying living cells, but it does not liquefy our own cells. It seems at present that there can be only one inter-

pretation of this—that these substances in the blood capable of liquefying blood cells cannot get into the cells, and so cannot liquefy them, but they can penetrate the cells of foreign species of animals and so liquefy them. In fertilization the liquefaction of the fertilized cell is incomplete. Only sufficient liquefaction of a cell takes place to cause the formation of the clear membrane on the outside, and the result is that the cell behaves as if it has been fertilized, and goes straight ahead with its development. It has been pointed out long ago that the cells of tumors or of cancers behave very much as if they were sex cells which have become fertilized. They bear a very strong analogy to a fertilized egg cell. A sudden explosion of energy takes place. A tremendous structure is built up out of a single cell. A cancer cell starts dividing and goes on *ad infinitum*. What causes this sudden awakening of a cell which apparently had reached its maximum development and become quiescent, and stopped dividing? Some light is thrown on this question by the above results.

A striking analogy to these experiments of Professor Jacques Loeb is provided by some experiments of his brother, Professor Leo Loeb of the University of Pennsylvania, Philadelphia. The latter is considered the leading authority on cancer in the United States. One of the most remarkable phenomena accompanying the formation of an embryo in mammalia, to which class of animals we belong, is the growth from the tissues of the uterus of a structure designed to supply the growing embryo with blood—the placenta. The growth of this structure may not inaptly be compared with that of cancer or tumor. There is a sudden liberation of energy among the cells of the uterus. The cells start dividing, and produce a large quantity of tissue. Prof. Leo Loeb has made the following discovery. He took virgin guinea pigs and, at various periods of their lives, made incisions in the uterus. Ordinarily nothing resulted, but, during a certain brief period, from four to nine days following the period of heat, typical placentas were produced. Any injury to the uterus at that stage produced a placenta. If he took the blood of guinea pigs in that stage and circulated it in the blood of another guinea pig not at that stage any incision whatever in the uterus of the second guinea pig produced a placenta. In other words, some substance was present in the blood of the guinea pig at that moment which rendered the cells of the uterus sensitive. That sensitiveness of the uterus at that critical period is obviously connected with the presence in the blood of some secretion from the ovaries, because if the ovaries were removed no such effect was observed, and it was never possible to get a placenta in any guinea pig deprived of its ovaries. Evidently the presence in the blood of that substance derived from the ovaries only occurs during the period following the period of heat. If it were continuous we should get, not the growth of a temporary placenta, but a permanent and continuously increasing growth—in other words, a cancer. That is to say, if sensitizing substances be present in the blood, cells which are injured in the body or receive certain excitations in the body, are very likely to start development, as if they had been fertilized, and to produce abnormal growths. I think you will agree with me that this is a rather striking analogy to the fact that we cannot fertilize, ordinarily, the eggs of the sea-urchin with foreign blood, but we can readily do so if we sensitize them first with special substances. What is believed to take place when

cancer is formed in the body is simply that some substance is present in the blood which so highly sensitizes ourselves that it becomes possible for our own blood to partially liquefy or fertilize our own cells.

To cause the liquefaction of a superficial area of a cell so as to make those liquefied droplets fuse together seems to be the only thing necessary to start the whole process of development. There is an interesting side issue attached to this fact. What becomes of the function of the spermatozoon? Apart from the question of inheritance, which we shall leave out of consideration this evening, its only function appears to be that of liquefying the surface layer of the egg which it enters. We are led to believe that the egg already contains everything necessary for its development, and necessary to start the processes of cell division, growth, and development, but that they cannot mix, and it is necessary that they should mix first. Around the superficial layer of the cell there would appear to exist a sort of solid emulsion of fat which, if mixed with the material of the cell, would cause the cell to develop, but it cannot mix because it is held in the superficial layer by the solid fat within that superficial layer. Directly that fat has dissolved it is free to enter the cell and develop. Whether we start it with spermatozoa, or with the blood of another animal, with acids or with any of the other substances I have mentioned is quite immaterial. All that is necessary is to mix the constituents which the egg-cell already contains. Therefore it is analogous to those fire extinguishers which only have to be turned upside down to produce a stream of carbonic gas which puts out the fire. Two things are held within the fire extinguisher, separated from one another, and until they are mixed nothing happens. Mix them, and immediately a chain of process occurs which, more or less, is beyond our control. Here we have stored up within each of our cells unlimited potentialities for cell division, growth, and development, and only the fact that two things which must mix are in different parts of the cell, and are kept in the different parts by the physical properties of those different parts, prevents those potentialities from being set free. Directly the outer layer and the inner part of the cell mix, the whole chain of process occurs. It would be very easy for me to go on to almost any time to-night talking about things just as interesting as these, and wearying you doubtless in the process, but I shall have mercy on you, and cease before you request me to do so.

In conclusion, it may relieve some of my audience and readers to know that all of the surgical operations to which I have alluded in this lecture, and in the accompanying note, were conducted under complete anæsthesia, and with all possible regard for the comfort and well-being of the animals.

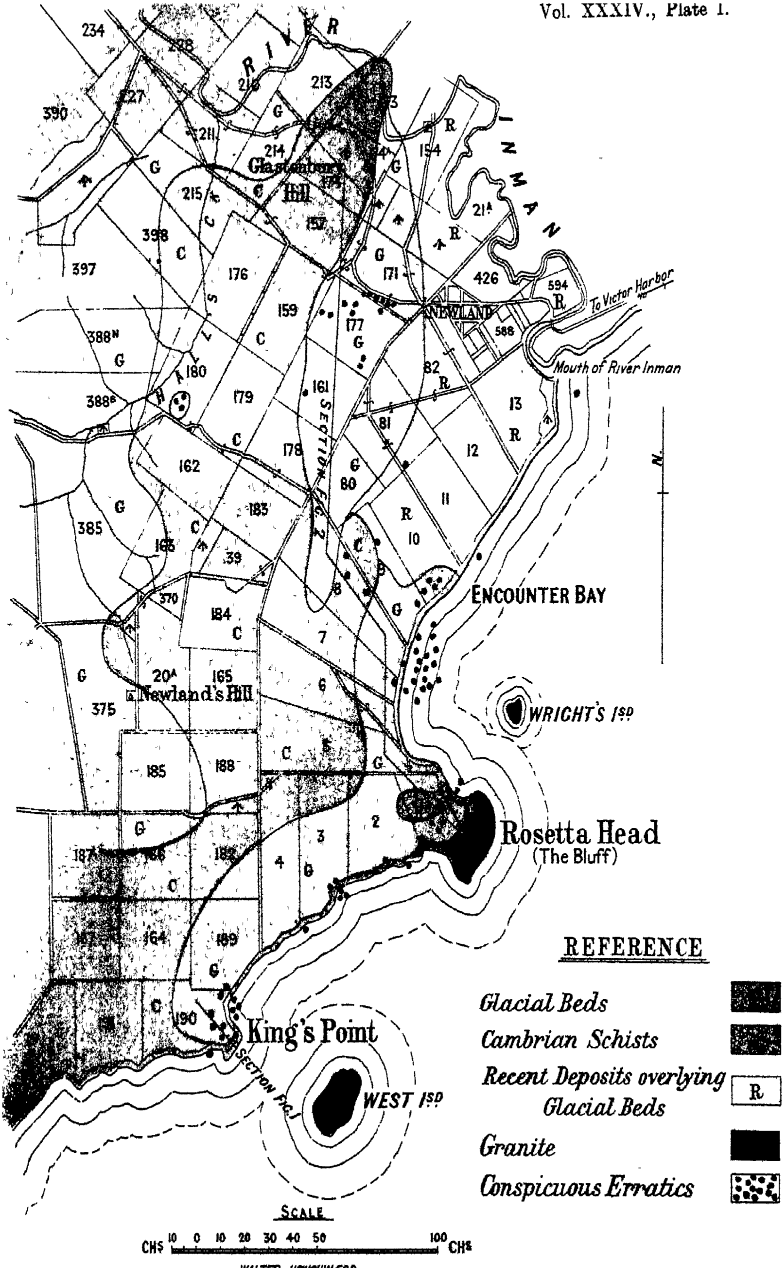
SUPPLEMENTARY NOTE BY PROFESSOR ROBERTSON.

In delivering the above lecture the lateness of the hour compelled me, greatly to my regret, to omit the discussion of one of the most interesting questions arising out of this field of investigation. I refer to the question whether or not death is a really necessary phenomenon—whether it is inevitably implied in growth, or whether it is not something superadded upon growth—some-

thing which is, comparatively speaking, accidental and pathological. As I have been told that this omission may have disappointed some of those who attended the lecture, I am taking the opportunity which has been afforded me of adding to the report of my lecture a brief account of the present status of this inquiry which may, in some measure, serve to supply the omission.

It was pointed out a number of years ago, by Weismann, that certain forms of living matter are, apart from accidental death, in the strictest sense immortal Thus the organisms which consist of a single cell, such as that lowest of all animal forms, Amœba, multiply by simple division into two or more parts. Each of these parts becomes a new individual, but as each of these new individuals contains some proportion of the substance, or, what is probably more essential, the structure of the mother cell, the life of the mother cell is, in the most literal sense, continued in that of its offspring. Similarly the sex cells of the higher animals, such as ourselves, are the direct descendants, by a repetition of such simple divisions, of the sex cells of the previous generation, whose life is therefore continued in them. We are, as it were, the perishable and transitory conduits of a thin unconscious stream of immortal life. Again, it is possible to propagate a tumor, by transplantation, from generation to generation of short-lived animals such as mice, so that the living material which is contained in such tumors to-day is, in some proportion, that which was contained in the tumor of a mouse who long ago died of old age. It is therefore not an inherent impossibility that living matter should be immortal, yet there is perhaps no element of our experience of which we feel so certain as that the sequel of maturity is death, and we are therefore led to inquire whether the attainment of maturity on the part of such complex and highly specialized living structures as ourselves may not involve, as a necessary and integral consequence, their exhaustion and death. While it would perhaps be too much to say that a clear and unqualified answer to this question has yet resulted from our inquiry, still the results which we have obtained are such as to lend very decided support to the view that decay and death are not the necessary complement of growth, but that they are the result of pathological processes superadded upon the normal and necessary phenomena of life.

I will endeavour briefly to describe one of the evidences upon which we base this opinion. The effect of temperature upon chemical reactions differs very strikingly from its effect upon the majority of purely physical processes. While purely physical phenomena, such as viscosity, diffusion, electrical conductivity, etc., are comparatively slightly affected by a rise in temperature, the velocity of a chemical reaction is very notably increased by a similar agency, so that as a general rule the velocity of a chemical reaction is doubled or more than doubled by a rise of 10 degrees Centigrade in the temperature. If, therefore, we are in doubt whether the velocity of some given process is determined by that of a chemical reaction or not we have only to impose this test upon it, namely:—to measure the velocity in question at two temperatures differing from one another by 10 degrees Centigrade. If the velocity is doubled or more than doubled by this rise in temperature we conclude that the underlying process which determined this velocity, which "sets the pace," as it were, is a chemical process. But we can do more than this: we can sort out different chemical reactions by observing the different



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...FFICE ADELAIDE A. Vaughan, Photo-litho.

SKETCH-SECTION OF KING'S POINT MORAINE (HALF A MILE)

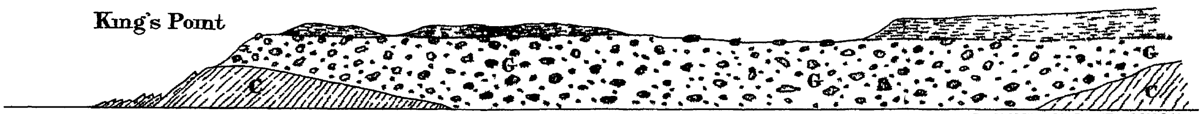

FIG. 1

SKETCH-SECTION OF ROSETTA HEAD MORAINE (3 MILES)

FIG. 2

RFFERENCE

Glacial Beds	G	*Recent Deposits overlying Glacial Beds*	R	*Granite*	
Cambrian Schists	C			*Conspicuous Erratics*	

effects of temperature upon them. The influence of temperature upon any one given chemical reaction is always the same, the degree of acceleration which any one chemical reaction undergoes when the temperature is raised 10 degrees is characteristic of, and serves to identify, that reaction. Now the velocity of the growth of a sea-urchin embyro or the division of a chemically, or naturally, fertilized sea-urchin's egg is doubled by a rise of 10 degrees Centigrade in the temperature at which it occurs, but the velocity with which a sea-urchin's egg dies, if its life is not saved by fertilization, is multiplied no less than 500 times by a similar rise in temperature. Unquestionably, therefore, the processes which underlie growth are very essentially different from those which underlie death.

Incidentally it may be pointed out that these results throw an interesting light upon an apparently wholly unconnected phenomenon. It has always been a matter of surprise to Arctic and Antarctic explorers to observe the density of the population of the intensely cold waters of these regions. The water swarms with minute organisms belonging to the lower forms of life, in fact they are usually far more abundant than they are in temperate seas. The reason for this phenomenon is now clear. Although these organisms develop more slowly in the cold waters, their lives are so enormously prolonged as to far more than make up for the delay in their development To prevent a misapprehension from arising in the minds of those who may not be familiar with biology, I may mention here that greater cold need not be expected to prolong our lives, because we are possessed of a physiological mechanism which maintains our blood at a very nearly constant temperature, so that the processes which occur within our tissues occur at the same temperature whether the climate to which we are exposed is a warm climate or a cold one. But the lowly organisms which so thickly inhabit the Arctic and Antarctic seas are "cold-blooded" animals, that is, their tissues are very nearly of the same temperature as their surroundings.

We are thus led to conclude, as I have pointed out, that the processes which underlie death are essentially different from those which determine growth and the attainment of maturity. Since they are so different it is at least possible that we may one day be in a position to arrest the one, while leaving unaffected the other, to prevent decay and death while maintaining the normal processes of mature life. When we recall the astounding advance in our knowledge and control of life which the last few years has yielded, he would be a daring man indeed who would venture to deny that we may yet, in the countless centuries of human effort which lie unrevealed before us, remove from our world the dread suspense and enter upon that supreme command of Nature which is the command of our own fates.

GENERAL INDEX.

[Generic and specific names printed in italics indicate that the forms described are new.]

PLATES I. TO XLVI.

Photo by W. Howchin

Rosetta Head (the Bluff) and ridge of morainic material as seen from Encounter Bay, a mile distant. Littoral reef of limestone is seen in the foreground.

Hussey & Gillingham, Printers, Adelaide

Phot by W Howchin

Rosetta Head, as seen from King's Point, also moraine and erratics overlying the cliffs of Cambrian schists which connect the two headlands

Hussey & Gillingham Printers Adelaide

Photo by W. Howchin.

Rosetta Head moraine and erratics viewed transversely from Encounter Bay. The range in the distance consists of older rocks.

Photo by T C ee lee

Rosetta Head mammae Group of granite cavities in lineal [illegible] near the base of Christenbury Hill Inman Valley Road

Hussey & Gillingham Printers Adelaide

Photo by W H Hutch n
Rosetta Head moraine Group of erratics in shallow water Encounter Bay The boulders have been left by the retreat of cliffs of boulder clay worn away by the sea

Hussey & Gillingham Printers Adelaide

Photo by W Howchin

Rosetta Head moraine. Great field of erratics, situated between high- and low-water marks, washed from boulder-clay, Encounter Bay. Wright Island in the distance.

Hussey & Gillingham, Printers, Adelaide

Photo by H Howchin

Rosetta Head moraine The largest erratic on the coast at Encounter Bay measures 23 ft in length It is of porphyritic granite and is weathering along joint plane

Hussey & Gillingham, Printers, Adelaide

Photo by H Houchi

Kings Point as seen from the east With the exception of the basal part of the extreme point it is entirely composed of morainic material Cambrian schists in the foreground

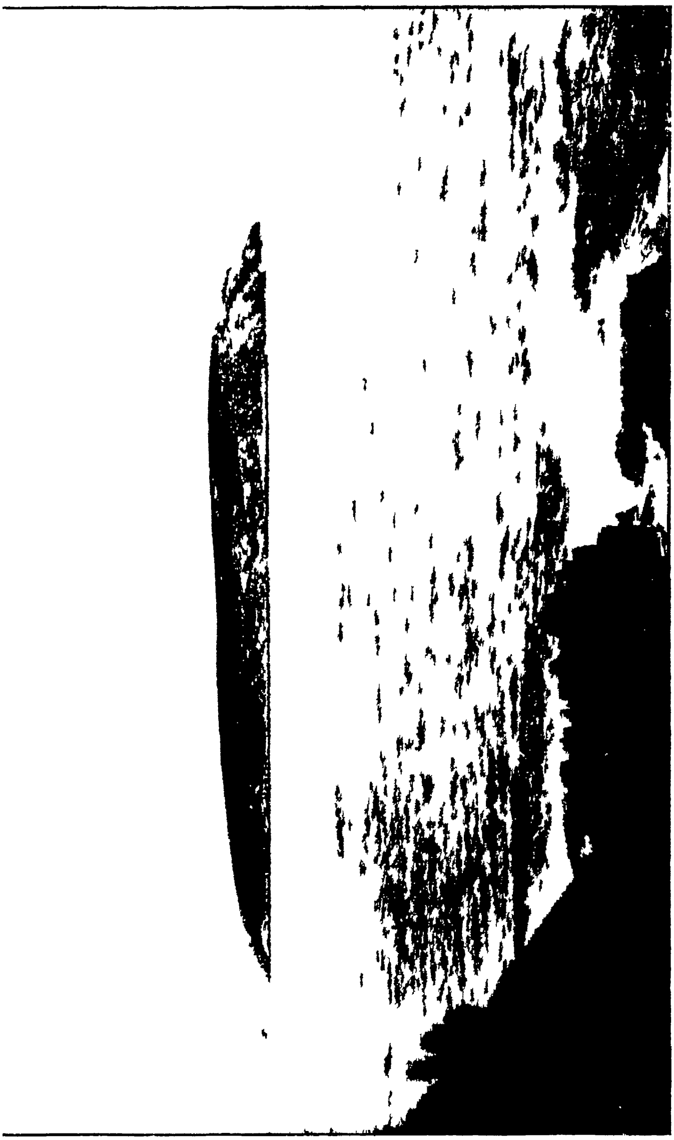

Photo by H Hercher

West Island off King's Point at a distance of half a mile from the latter Shows an ice smoothed outline

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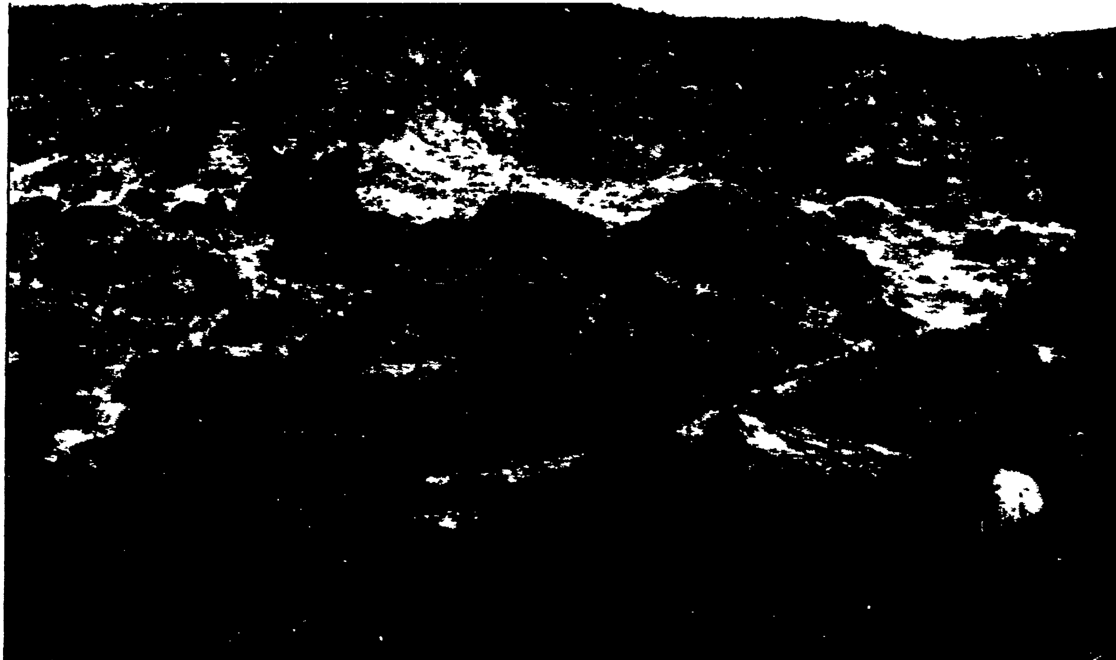

Photo by H Howchin

View on the summit of the moraine at King's Point. A ridge of the upper (sandy) beds is seen at the back and a number of large erratics resting on boulder clay in the foreground.

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Photo by W Howchin

View on the eastern side of the moraine at King's Point half way up with a large boulder perched near the summit

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Photo by W Howchin

The large boulder seen in Plate xiii, at a nearer view. The erratic which is 8 ft long, is of granite, and rests on undisturbed glacial till

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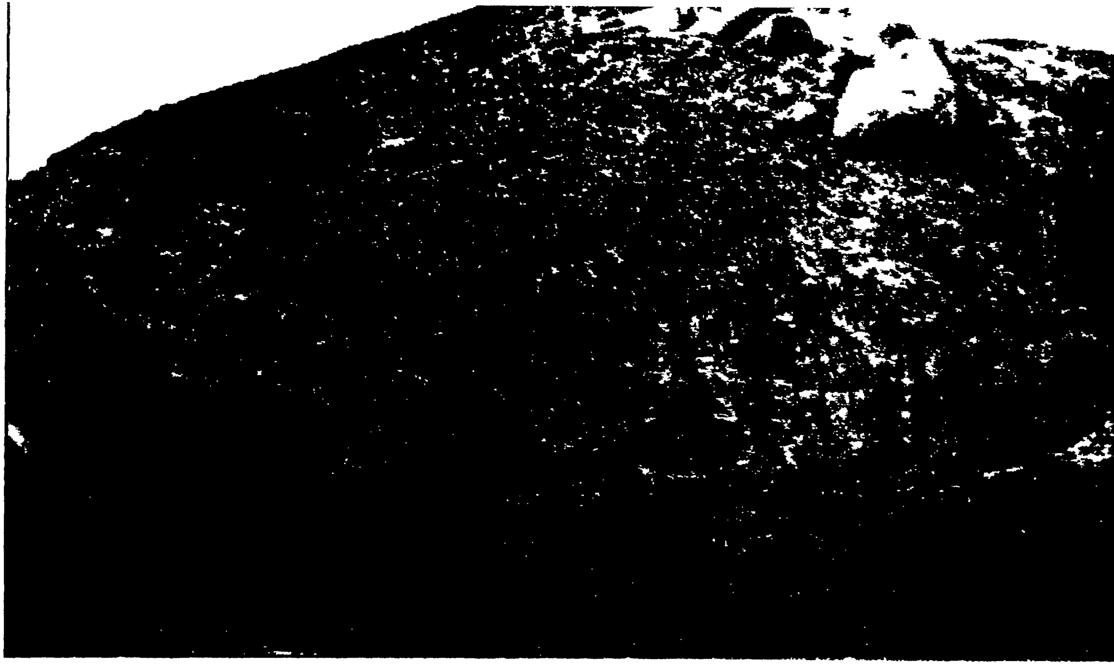

Photo by W. Howchin

King's Point moraine, facing the sea, showing a group of large erratics near the summit and a washout in glacial till on the left hand side.

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A nearer view of the washout seen on the left hand side in Plate XV showing the stony character of the till

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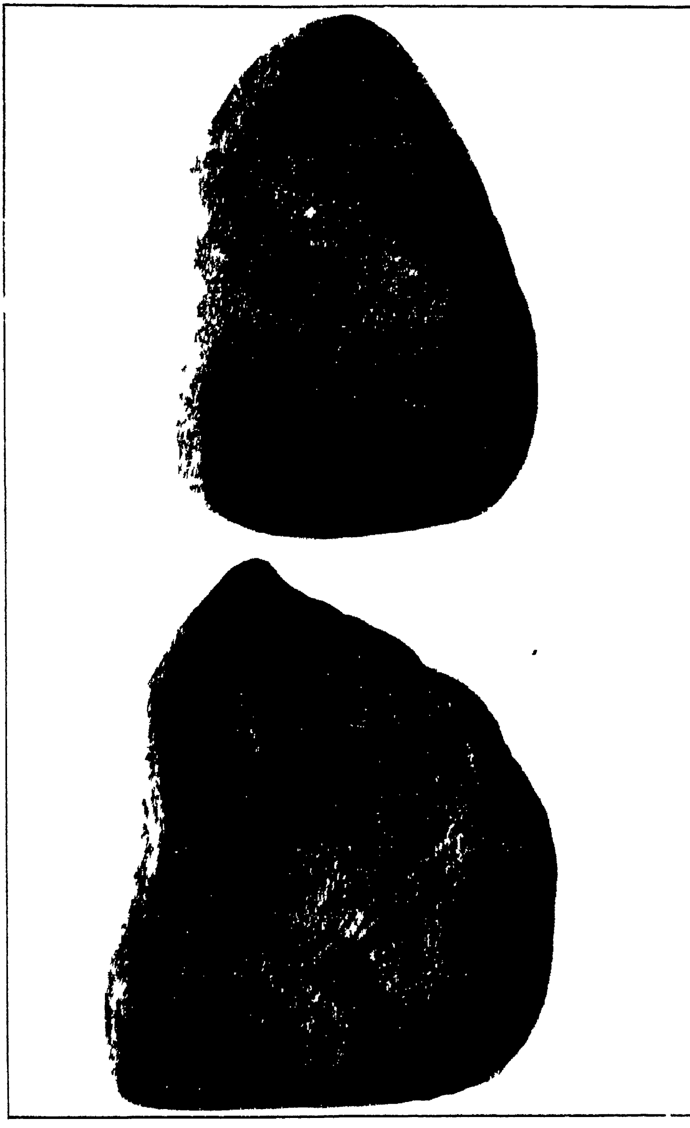

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Two examples of glaciated stones from the King's Point moraine
About half natural size

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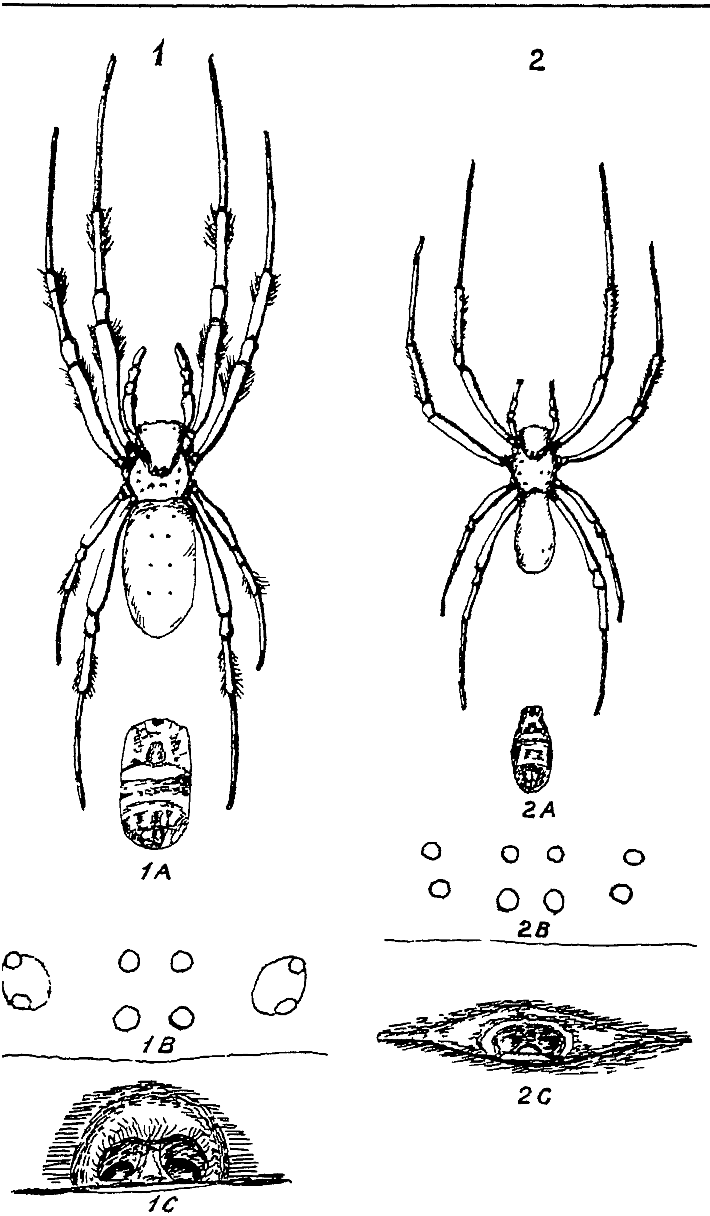

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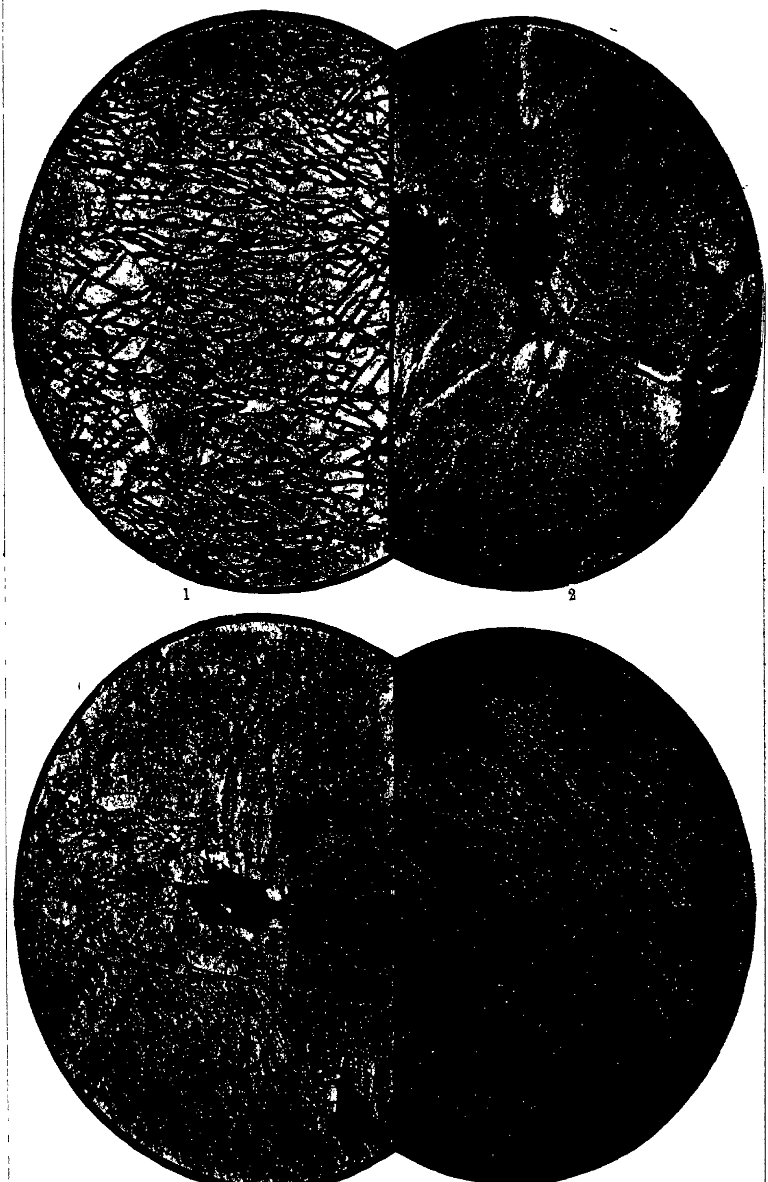

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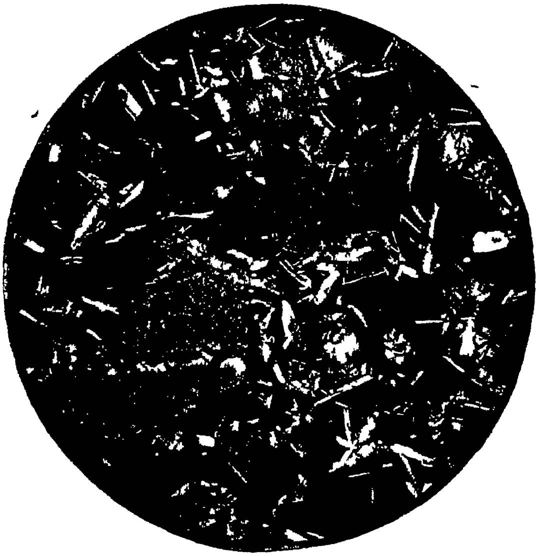

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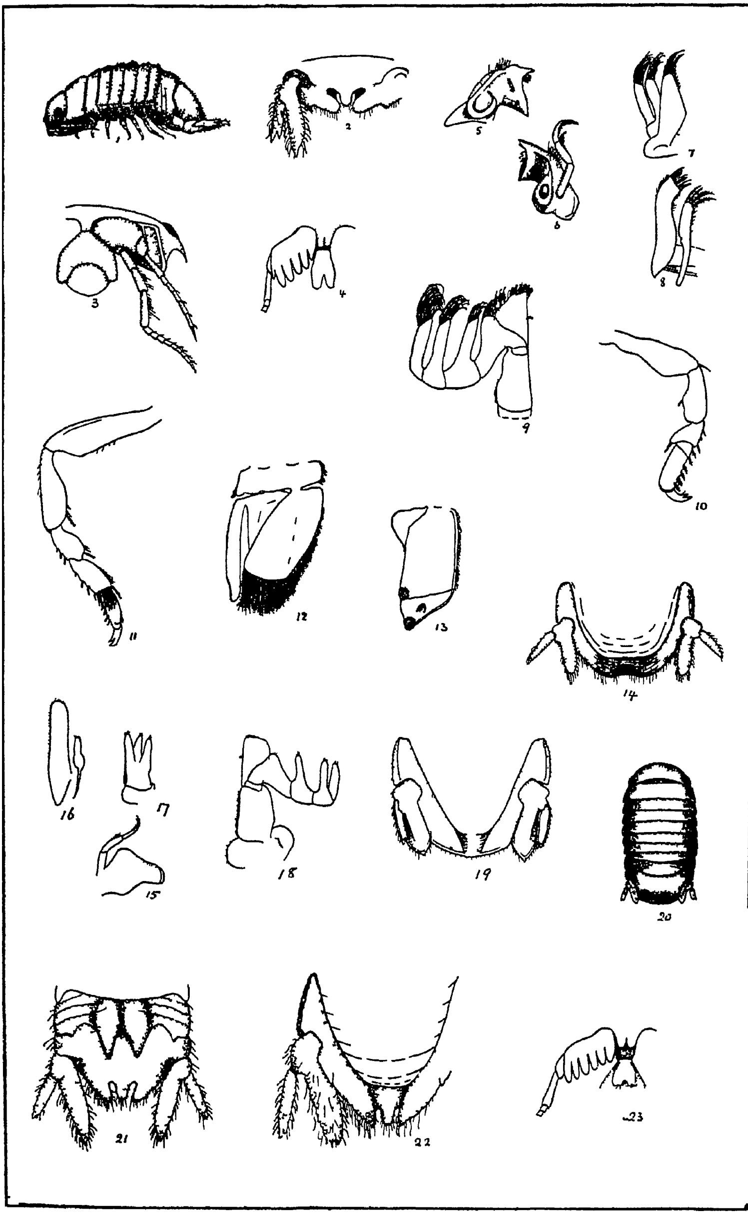

CYMODOCE TUBERCULOSA (Stebbing) C TUBERCULOSA, n var, BISPINOSA

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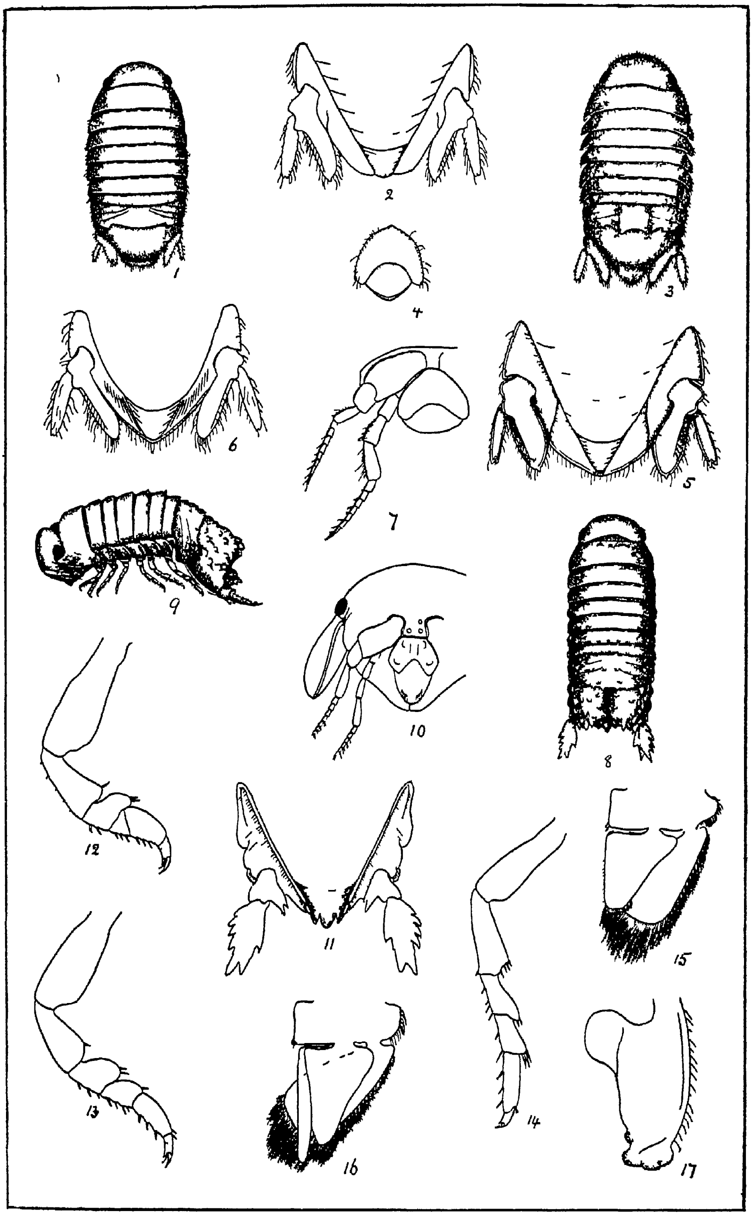

CYMODOCE TUBERCULOSA, n. var., BISPINOSA. C. SEPTEMDENTATA, n. sp.

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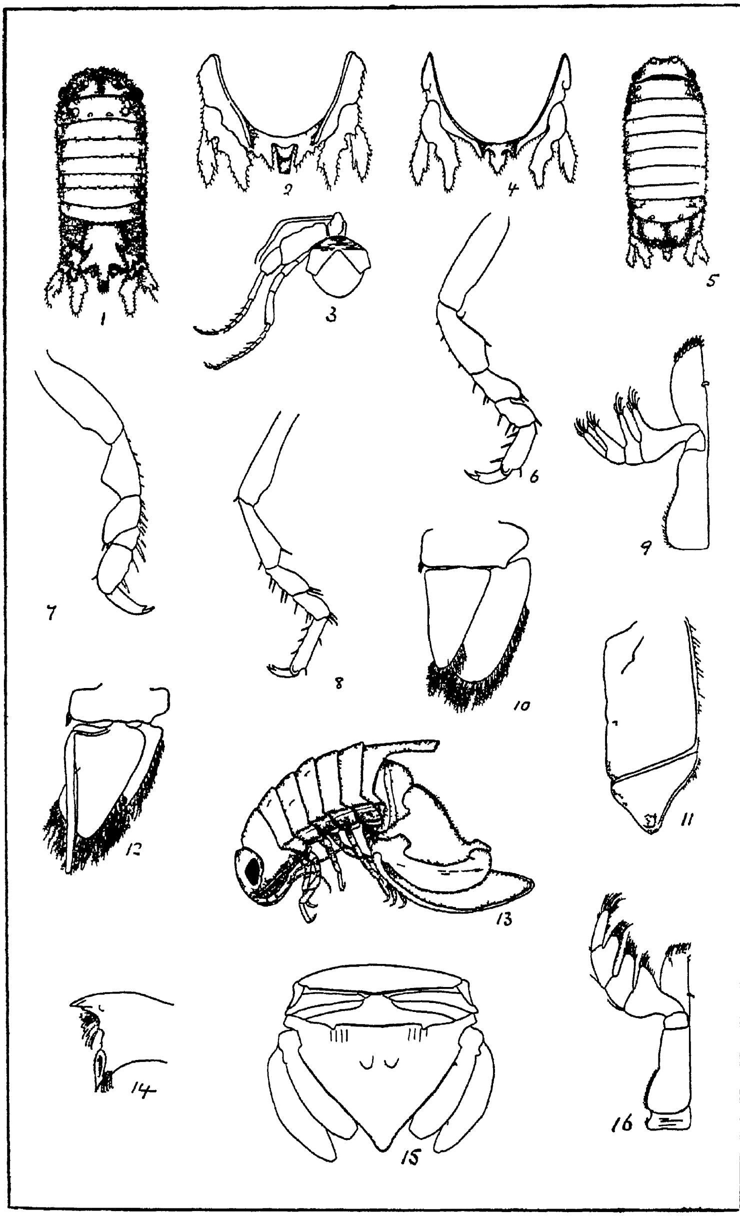

CILICÆA TRIDENS, n sp ZUZARA VENOSA (Stebbing)

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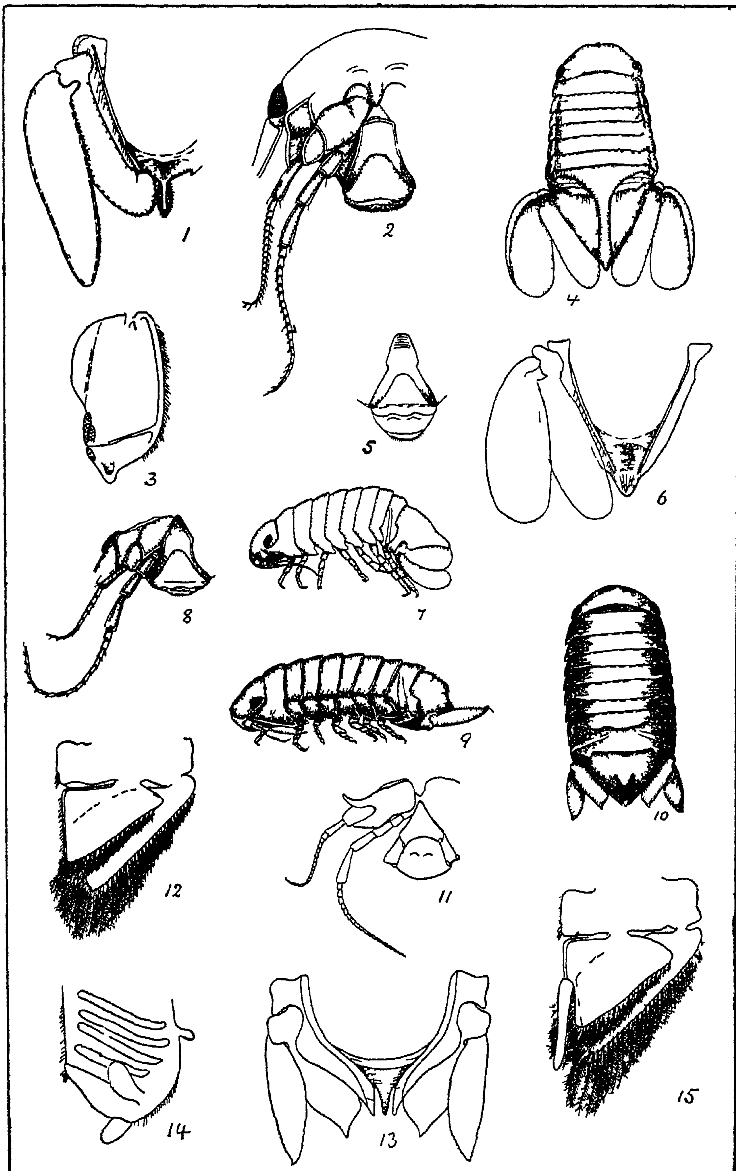

ZUZARA VENOSA Z (ISOCLADUS) EXCAVATA, n sp Z (EXOSPHÆROMA) LÆVIS, n sp CERCEIS TRISPINOSA Haswell)

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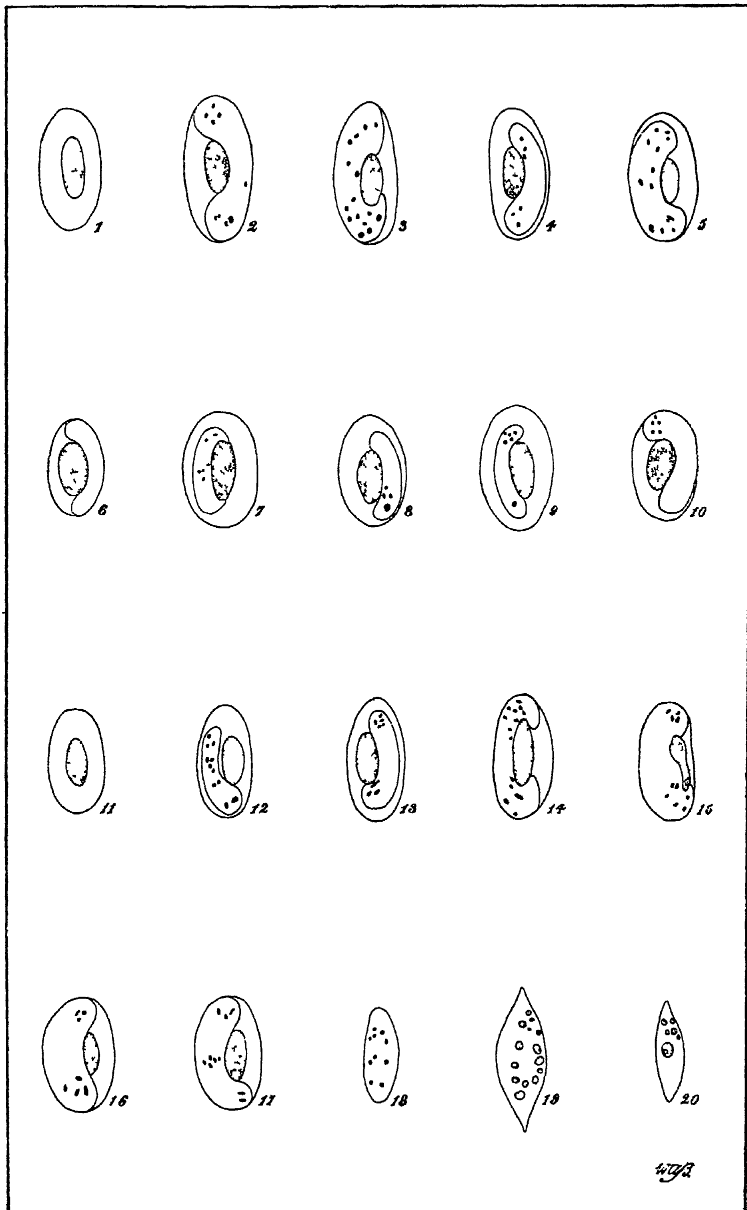

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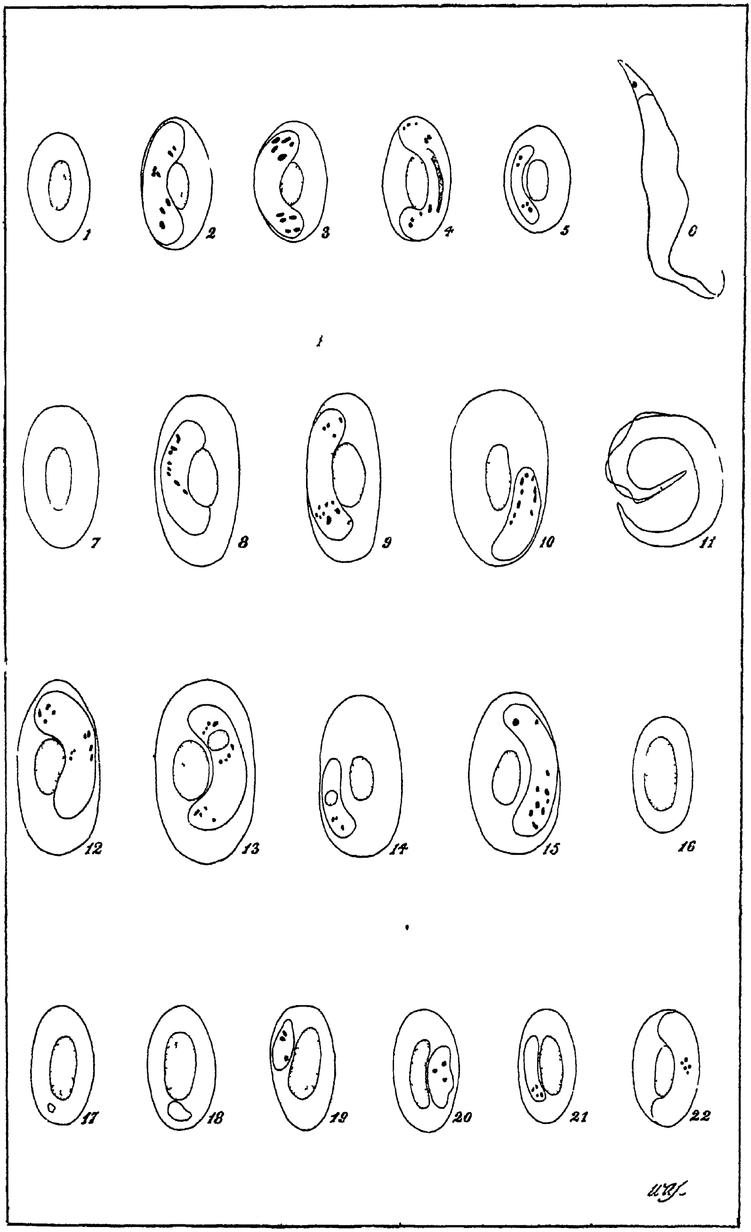

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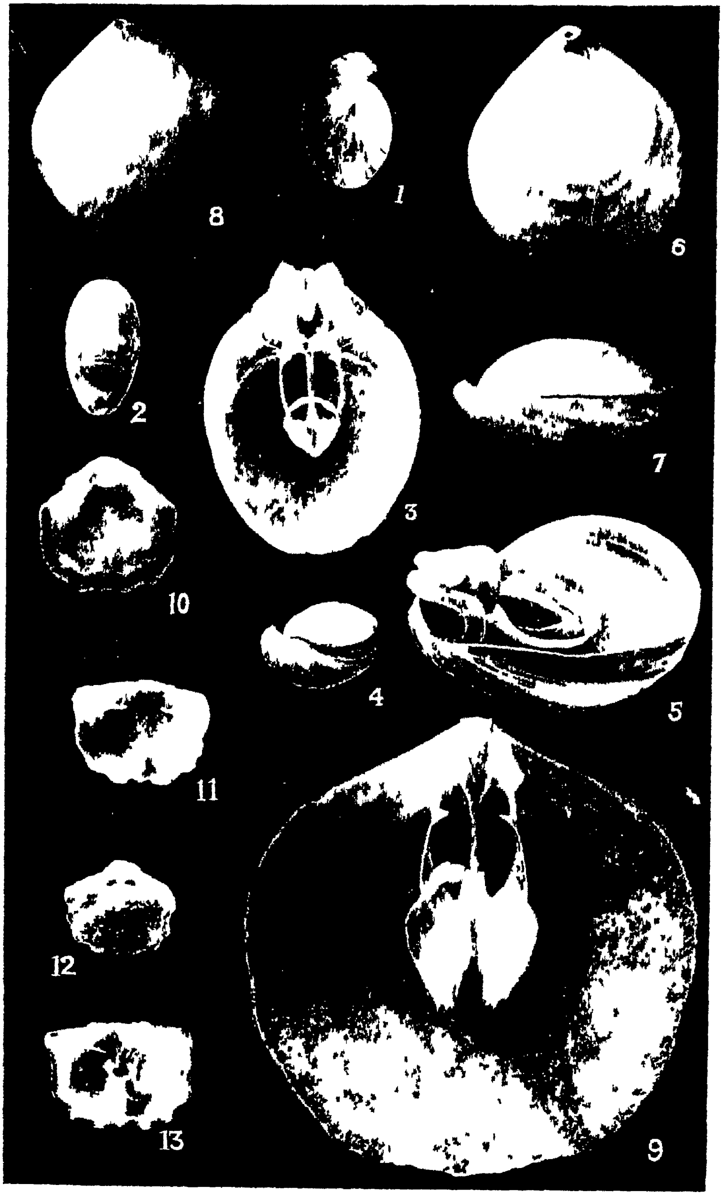

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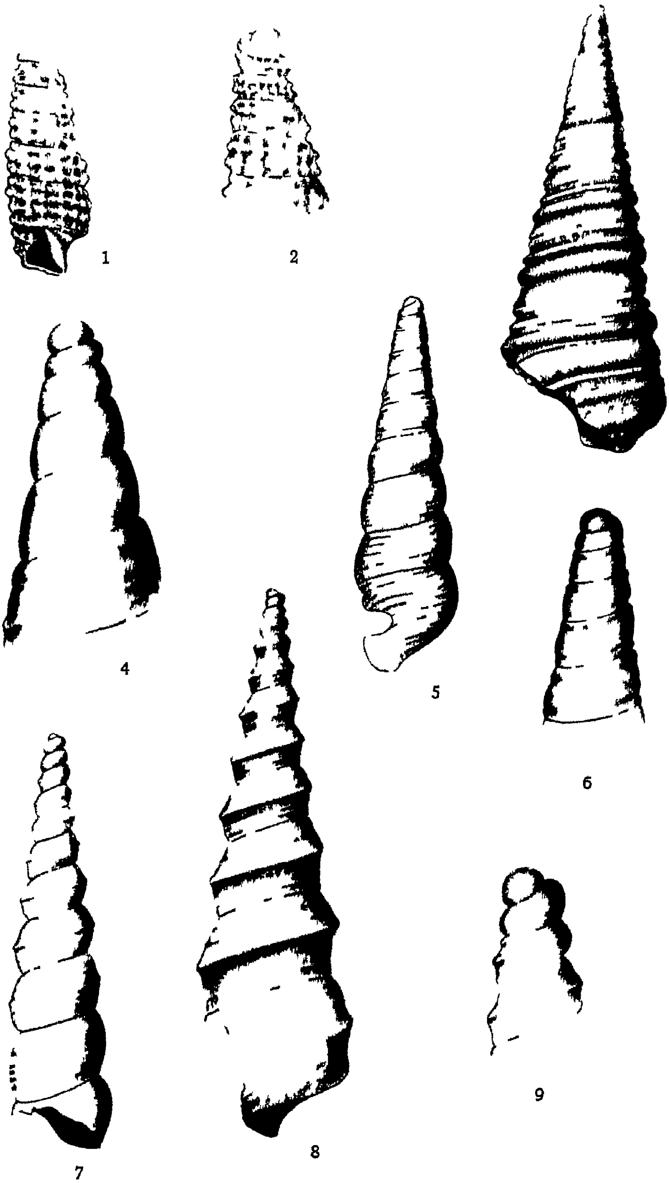

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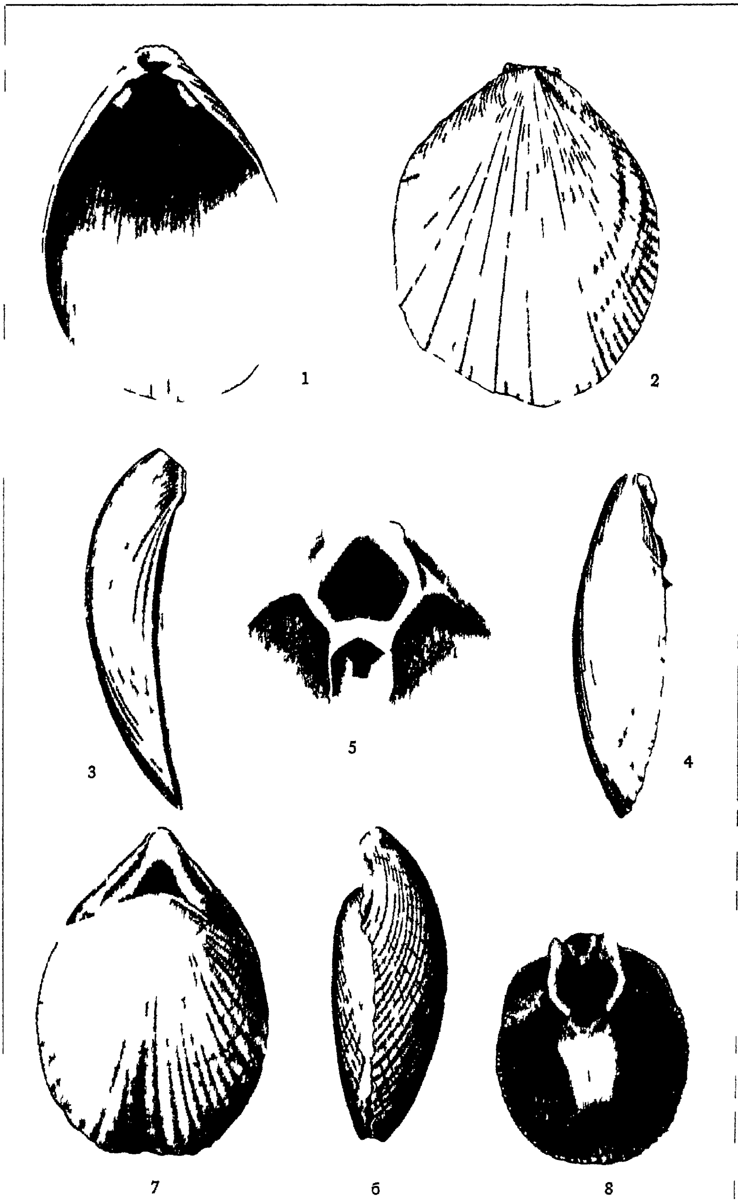

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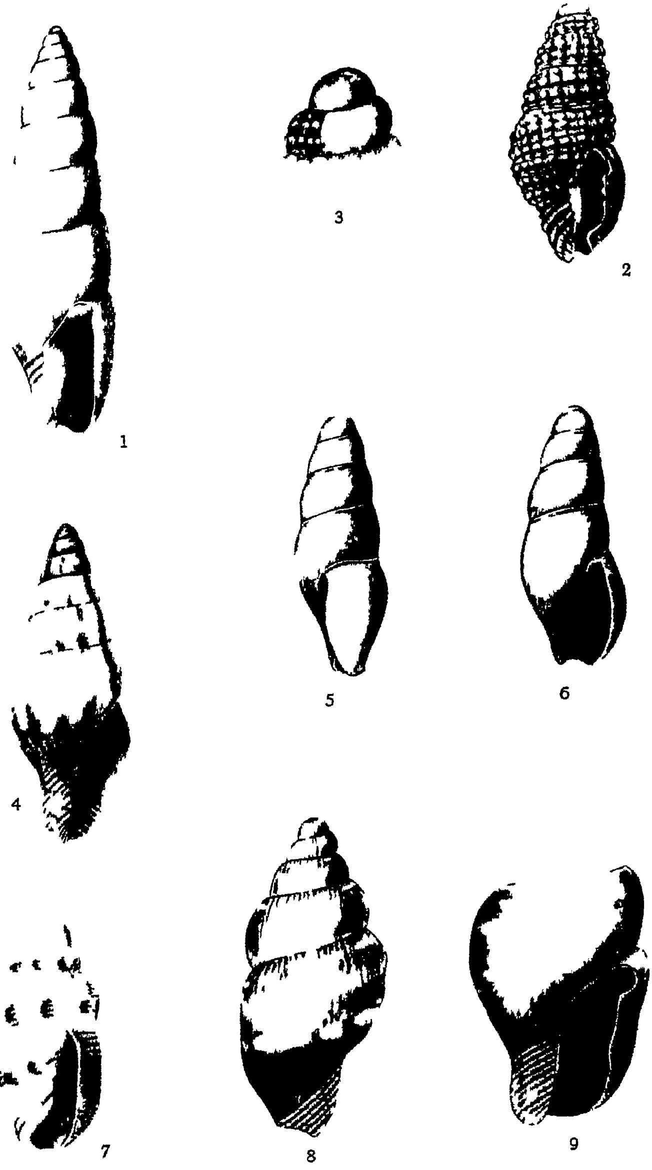

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GEOLOGICAL SKETCH-MAP

of the Hundreds of Kondoparinga, Myponga, Nangkita, Goolwa, and Encounter Bay, South Australia with special reference to the Glacial Beds of Permo-Carboniferous Age

BY WALTER HOWCHIN F.G.S.

REFERENCES.

Pre-Cambrian Complex	(dotted)	Cambrian Quartzites and Schists	(blank)
Glacial Beds (Permo-Carboniferous)	(blank)	Swamps	(black)

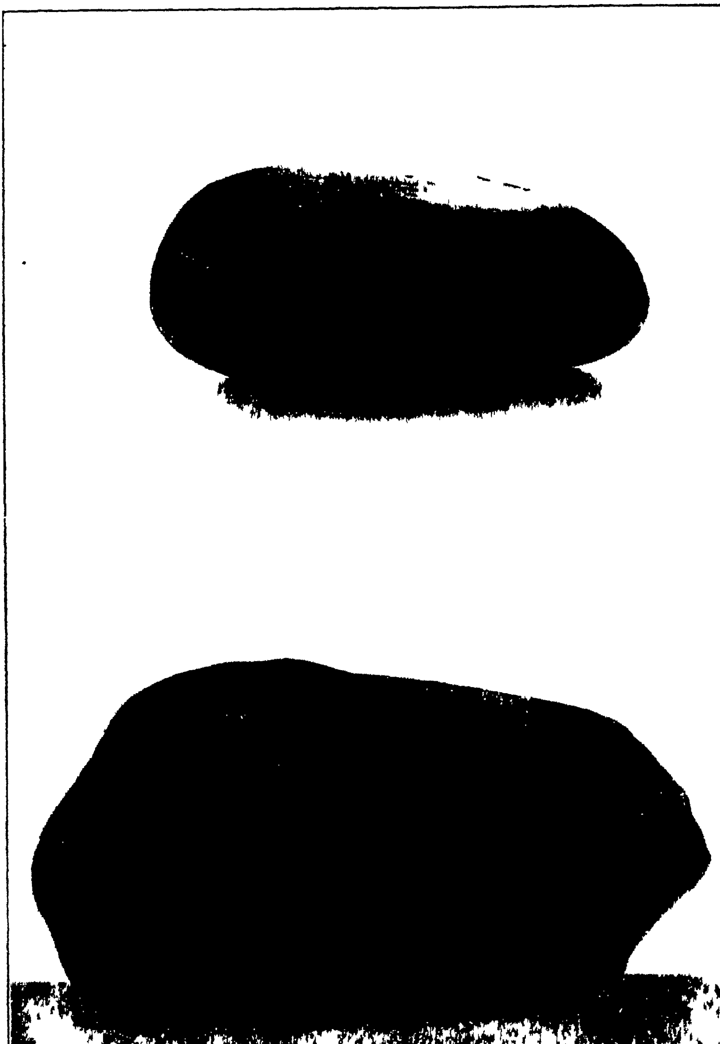

Photo by W Howchin

Upper figure. An erratic of black quartz showing glacial polish, facets, and striæ Obtained *in situ* in the quarry near the Square Waterhole figured in Plate xxxviii Half natural size

Lower figure Glaciated erratic of fine grained schist, found *in situ* in road-cutting of glacial till west of Strathalbyn (See Plate xxxix) The stone is faceted at diverse angles and strongly scored with striæ Two-thirds natural size.

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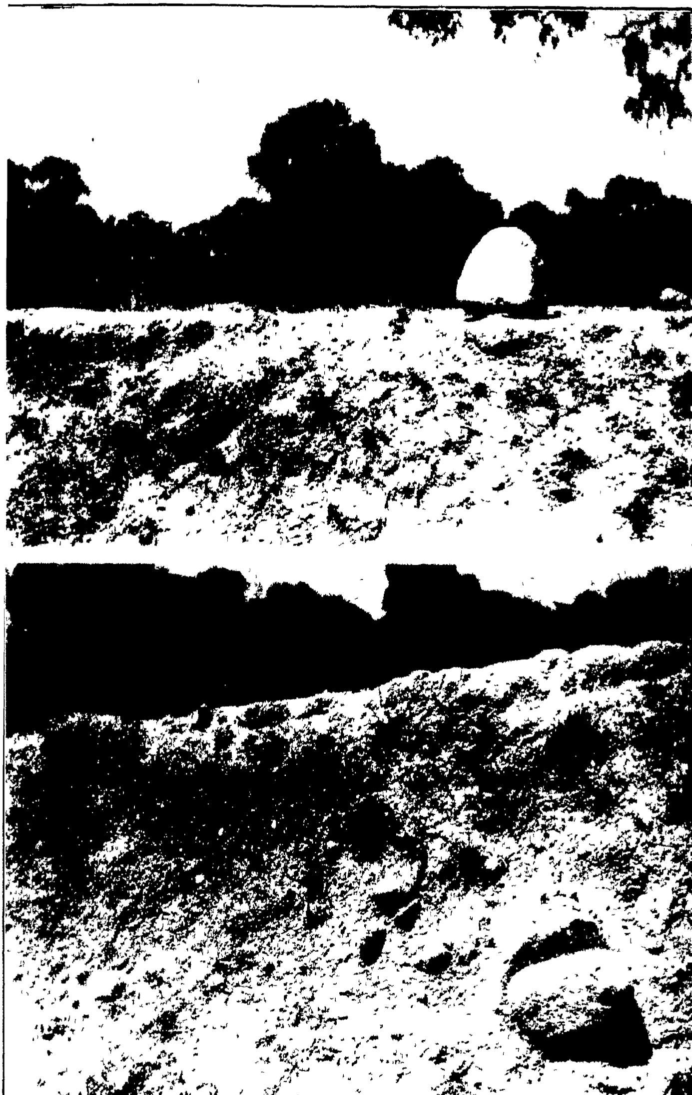

Photo by W. Howchin

Two views of glacial till, exposed in a road cutting west of Strathalbyn.

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Photo by W Howchin

Quarry in glacial sandstone with erratics situated on the main road a little south of the Square Waterhole, and near the southern boundary of the Hundred of Nangkita A glaciated erratic from this quarry is reproduced by photograph on Plate XL

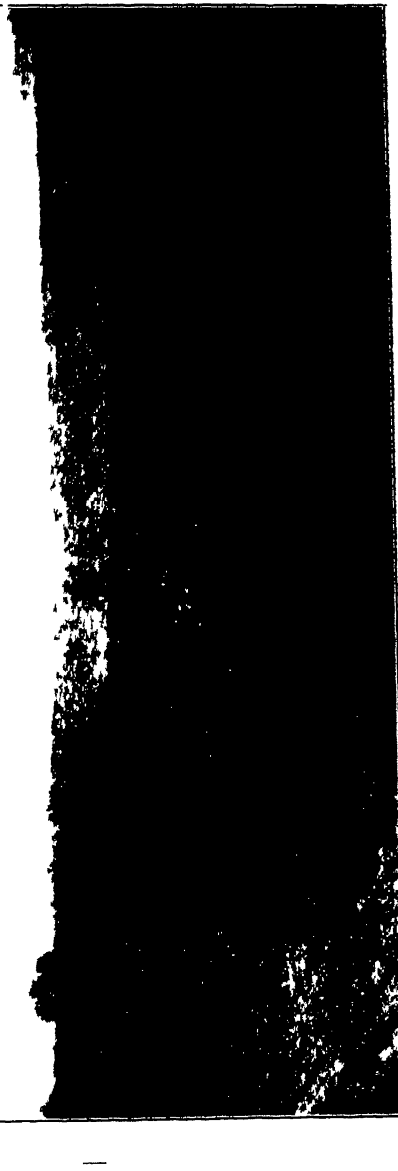

Photo by W Howchin

Cleland's Gully Range near Mount Compass composed of glacial sandstones etc as seen from the main road on the south side

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Photo by H Howchin

Glacial sandstones on the west side of Mount Compass forming the watershed between the east and west drainages and the dividing line between the Hundreds of Nangkita and Myponga

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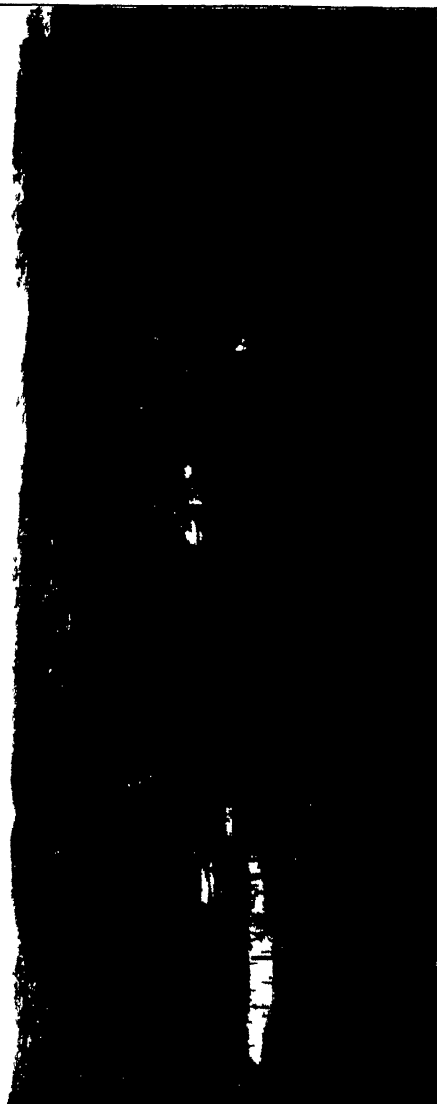

Photo. by W. Howchin

General view of Mount Compass glacial basin from Wood Cone, looking north, with Mounts Compass, Moon, and Effie in the middle distance. These hills form rounded inliers of Pre-Cambrian rocks surrounded by glacial sand-stones and clay, with swamps in the lower levels.

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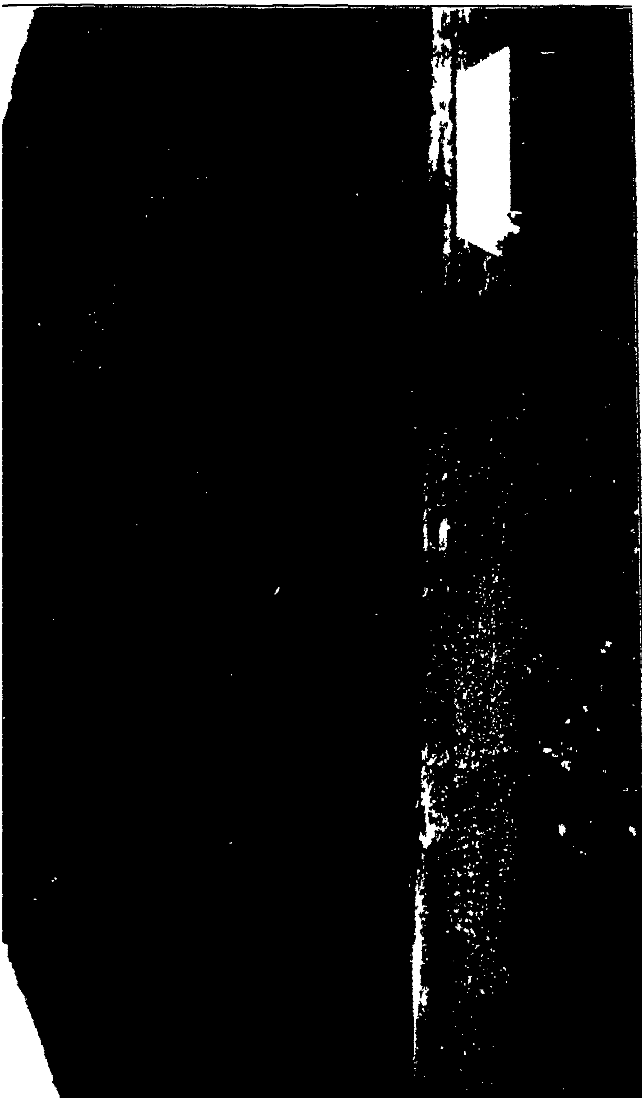

Photo by W Howchin

End view of Mount Moon showing abrupt termination of the hill on the west, with wind gap in the foreground.

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View of Mount Compass glacial basin, as seen, looking south. A portion of Mount Moon appears on the left hand, Mount Compass township in the centre and hills of glacial sandstone in the distance

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Photo by W Howchin

Sandy flat of disintegrating glacial sandstones between Mount Compass and the Willunga Ranges which are seen in the distance The view includes the almost level watershed of the Finniss River which flows to the east and the Myponga River which flows to the west

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Photo by W. Howchin

Glacial sandstone with irregular pockets of boulders forming a cliff in the bed of the River Finniss three miles above the railway bridge

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Photo. by W. Howchin

Another river-cliff, near the one figured in Plate xli., composed mostly of boulders, one of which (a granite boulder) measures 4 ft. 6 in. by 3 ft. Overlying the boulder-bed is a glacial-sandstone, showing contorted lines of bedding.

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Photo by W Howchin

Quarry in glacial sandstone situated in the banks of the River Finniss above the railway bridge The upper portions of the quarry face show strongly curved bedding planes and the more compact stone develops similar evidence of contemporary distortion when weathered (See Plate xliv)

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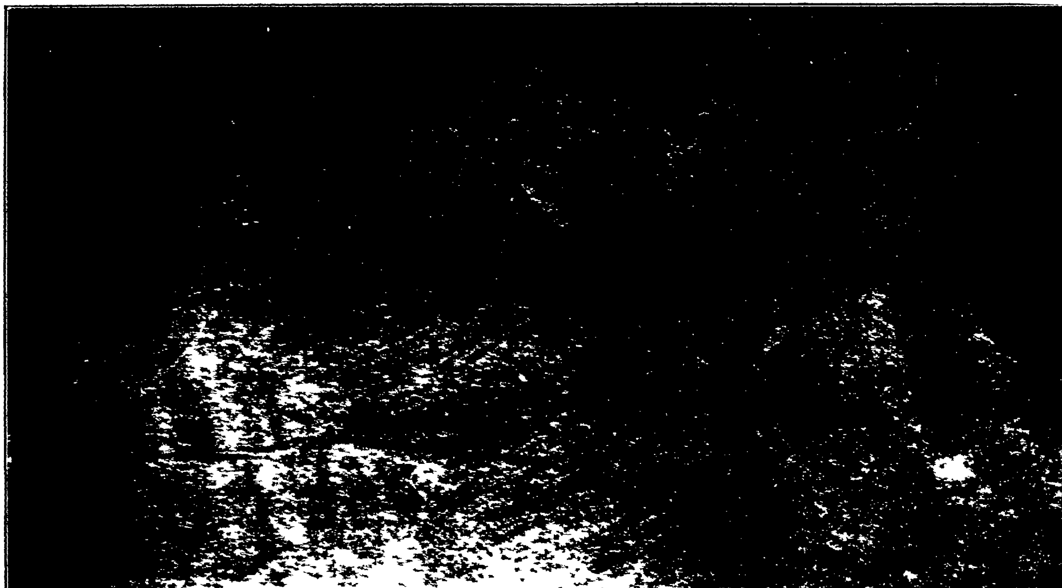

Photo by W Howchin

Photographic reproduction of the Finniss River sandstone as exposed in the stone pillars at the entrance to the Adelaide University grounds The stone had been smoothly worked, but as the result of weathering the original grain has been brought into relief, and displays broken and crumpled planes of deposition

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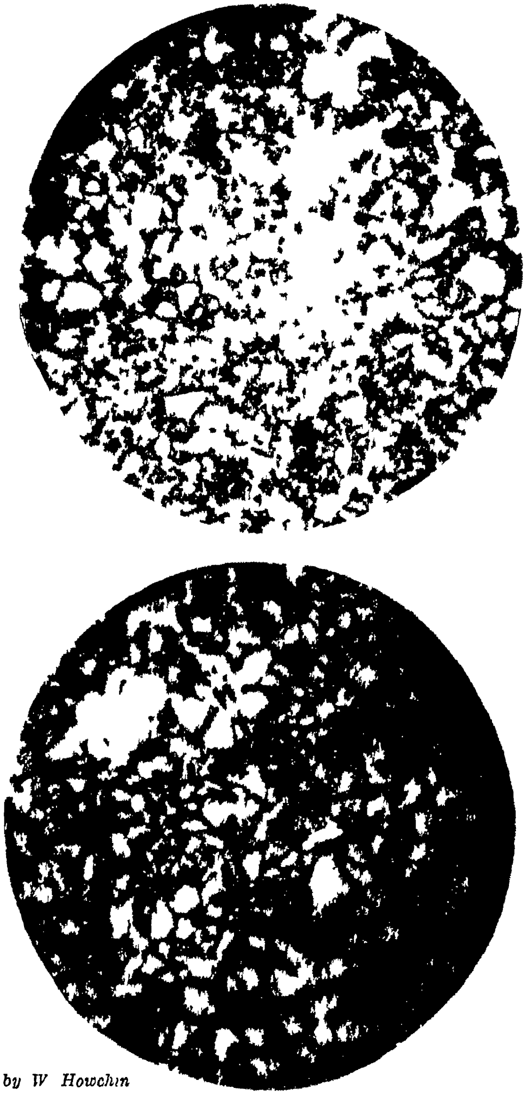

Photo by W Howchin

Two microscopic sections of the Finniss River sandstone showing the sharp and angular forms of the grains The finer material is of the same kind and has the features of a glacial rock flour Magnified 18 diameters

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LINGUATULA DINGOPHILA. Enlarged 6 diam.

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TRANSACTIONS AND PROCEEDINGS

AND

REPORT

OF THE

ROYAL SOCIETY of SOUTH AUSTRALIA

(INCORPORATED).

VOL. XXXV.

[WITH TWENTY-SEVEN PLATES AND ONE FIGURE IN THE TEXT.]

EDITED BY WALTER HOWCHIN, F.G.S.

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CONTENTS.

Appendices.

NEW SPECIES OF BORONIA.

By J. H. MAIDEN, F.L.S., and J. M. BLACK.

[Read August 2, 1910.]

PLATE I (upper half).

Boronia palustris, *sp. nov.*

Suffrutex humilis glaber 10-25 cm. altus, circum paludes crescens, ramis erectis dichotomis, foliis lanceolatis integris 1-nerviis planis 8-15 mm. longis, floribus solitariis vel geminatis terminalibus et axillaribus, pedunculis brevibus obconicis, bracteis lanceolatis pedunculo longioribus, sepalis ovato-lanceolatis 3-nerviis rubescentibus intus puberulis reduplicato-valvatis 5 mm. longis, petalis obovatis albis imbricatis calyce brevioribus, staminibus 4, filamentis ciliatis apice glandulosis, ovulis collateralibus.

Found in flower by H. H. D. Griffith on the edge of swamps near Cape Borda and Starvation Creek, Kangaroo Island, October, 1908.

This is a very distinct species, standing nearly midway between *Boronia* and *Zieria*. It has the thick, entire disk of the former genus, but only the 4 stamens of the latter. It has been decided to place it in *Boronia*, on account of the undivided disk, the collateral ovules, and the filaments ciliate for three-fourths of their length, and glandular at the apex. The two firstnamed characters are never found in *Zieria*, and ciliate filaments are rare in that genus. In habit the new species closely resembles *B. parviflora*, Sm., but is distinguished from that and all other Boronias by the 4 stamens, and from most of them by the sepals being longer than the petals.

EXPLANATION OF PLATE I. (upper half).

Boronia palustris, sp. nov. Plant with flowers and carpel.

Additions to the Flora of South Australia.

By J. M. Black.

[Read August 2, 1910.]

Plate I. (lower half).

The following list contains the names of plants recently found growing spontaneously in South Australia, with notes on two species already recorded for this State. The aliens (distinguished by an asterisk) are additions to those described in the "Naturalized Flora of South Australia," and the Australian species are supplementary to those given in Tate's "Flora of Extra-tropical South Australia," or subsequently recorded in the Proceedings of the Royal Society:—

Fumariaceæ.—**Fumaria densiflora*, DC. (considered by some botanists as a variety of *F. officinalis*, L.). Adelaide plains.—A native of Europe.

Polygalaceæ.—**Muraltia Heisteria*, DC. Roadside between Morialta Gully and Norton's Summit.—South Africa.

Caryophyllaceæ.—**Alsine tenuifolia*, Crantz. Port Lincoln (H. H. D. Griffith).—Europe.

Linaceæ.—**Linum gallicum*, L. Roadsides, Balhannah —Mediterranean region.

Leguminosæ.—*Pultenæa adunca*, Turcz. Warrunda, Port Lincoln railway (H. H. D. Griffith).—Western Australia. Determination confirmed by Professor Ewart on comparison with specimens in the National Herbarium, Melbourne. The leaves of all our specimens are scabrous and hairy, without any hooked point. **Vicia sativa*, var. *angustifolia*, Ser. (*V. angustifolia*, Roth). Roadsides near Crafers. —Europe.

Compositæ.—**Erigeron canadensis*, L. Roadsides, Renmark (E. C. Black).—North America.

Note on *Olearia picridifolia*, Benth. (Plate i.).—This handsome shrub, reported in *Fl. Aust.*, iii., 487, from the neighbourhood of Lake Torrens, and not mentioned in Tate's work, has been found in the remaining scrub at Halbury and Strathalbyn. The heads of the Halbury plants are larger than those from Strathalbyn and contain more rays —about 30 as against 15. Professor Ewart found that the specimens agreed with the types from Lake Torrens This species differs from *O. rudis*, F. v. M., in the narrow, entire leaves, slender branches, and short outer row of pappus-hairs.

CONVOLVULACEÆ.—**Convolvulus arvensis*, L. Becoming very common near Adelaide and along the railways northwards into the agricultural areas.—Cosmopolitan.

BORAGINACEÆ.—**Echium italicum*, L. Near Mannum (H. H. D. Griffith).—Mediterranean region.

SOLANACEÆ.—**Datura Stramonium*, L., var. *Tatula*, DC. (*D. Tatula*, L.). Fulham.—Most warm countries.

Note on *Solanum coactiliferum*, Black. Kew remarks that this species "is very closely allied to the South American *S. elæagnifolium*, Cav., which differs in having pentamerous flowers."

SCROPHULARIACEÆ.—**Bartsia Trixago*, L. Greenhill Road.—Mediterranean region. *Glossostigma spathulatum*, Arn. Port Lincoln and Kangaroo Island (H. H. D. Griffith).—New South Wales and Queensland.

CHENOPODIACEÆ.—**Beta vulgaris*, L. Reedbeds.—Europe and Western Asia.

EUPHORBIACEÆ.—**Euphorbia helioscopia*, L. Port Lincoln (H. H. D. Griffith).—Europe.

LILIACEÆ.—**Allium triquetrum*, L. Roadsides, Blackwood.—Mediterranean region.

RESTIACEÆ.—*Loxocarya fasciculata*, Benth. Warrunda, near Port Lincoln (H. H. D. Griffith).—Western Australia.

GRAMINEÆ.—*Cenchrus tribuloides*, L. Swamps near River Murray (H. H. D. Griffith).—United States and Canada. *Isachne australis*, R. Br. Myponga (H. H. D. Griffith).—Eastern Australia. **Cynosurus echinatus*, L. Mount Lofty and Stirling (H. H. D. Griffith).—Mediterranean region. **Poa pratensis*, L. Rare near Adelaide and in hills.—Temperate countries. **Poa bulbosa*, L. Rare along River Torrens, near Adelaide, and numerous along the Henley Beach Road, where it usually assumes the viviparous form.—Europe.

EXPLANATION OF PLATE I. (lower half).

Olearia picridifolia, Benth. Plant with flowers and akene.

Preliminary Report on the Discovery of Native Remains at Swanport, River Murray; with an Inquiry into the Alleged Occurrence of a Pandemic among the Australian Aboriginals.

By E. C. Stirling, M.D., Sc.D., F.R.S., Hon. Fellow of the Royal Anthropological Institute.

[Read July 13, 1911.]

Plates II. to IX.

A recent discovery (April, 1911) of an aboriginal burial-ground at Swanport, on the River Murray—a small settlement about 3½ miles below Murray Bridge—is of more than usual interest, not only on account of the large number of interments that have taken place within a very limited area, but also, and more particularly, from the fact that they all occurred before the arrival of the first colonists in South Australia. Thus there can be no question that these remains represent the pure strain of aboriginals, whose methods of interment, moreover, have been uninfluenced by the practices of civilization. Whether the cause of what, at first sight, appears to be an unusual mortality is attributable in any way to such influence, direct or remote, will be part of the object of the present inquiry.

The Crown Lands Department of South Australia, having of recent years initiated a policy of reclaiming, for agricultural purposes, various swamp lands bordering on, and at times overflowed by, the River Murray, began a work of this kind in April, 1911, on a submerged area lying immediately to the north of Swanport, on the right bank of the river. As an essential part of this project it became necessary to remove soil from the adjacent dry ground to provide material for an embankment designed to exclude the river waters from the swamp.

This soil was, in part, taken from a small Government reserve abutting both on the river and on the southern end of the swamp itself (plate ix.).

Opposite to the water frontage of the reserve, at a distance of 60 or 70 yards from the bank of the river, which here takes a trend in an east-south-east direction, an isolated granite mass shows above the surface of the water at ordinary levels. This for many years was a bare, exposed rock, but a willow truncheon planted some years ago in a crevice has

now grown into a tree which effectually conceals it from view. The navigation channel lies in the wider portion of the stream between this rock and the left bank. Within the area of the reserve, close to the water's edge and right opposite to the rock in the river, a group of several other large masses of the same material emerges from the ground and, I understand, that a ridge of granite connects the latter with the former, rendering the intervening channel too shallow for navigation except for small boats. Along the adjacent river margin, and for some distance lower down, willows have been planted at the water's edge and have grown luxuriantly About 200 yards below the reserve is a small island between which and the right bank is a narrow channel. This island, like the adjacent bank, is thickly overgrown with closely-planted willows.

Both the isolated rock in the river and the neighbouring group on the bank are portions of a long line of granite outcrop running, approximately, from west-north-west to east-south-east Other portions of the same outcrop can be seen on the farther side of the river and in the opposite direction on the solid ground beyond the swamp that is being reclaimed. The line of outcrop extends much farther in either direction.

Within a few feet of the river the natural surface of the ground rises, with a gentle incline of about 1 in 10, away from, and in a direction at right angles to, the river bank, and, as one stands with the back to the latter looking up this incline, the ground surface shows a similar gentle slope to the right and left. Thus the section parallel to the river and across the incline, which was that actually made in the removal of the soil, shows a gentle and even convexity (plates ii., iii., and iv.).

In former days a group of the indigenous Cypress Pine (*Callitris* Sp.) grew upon the slope, but they have now all disappeared from that immediate locality, though a few trees still remain in the neighbourhood.

Recourse was had to this bank to provide material for the embankment, and the removal began at its lowest part within a few feet of the stream, and, of course, as the cutting advanced away from the river the deeper became the face of the exposed section.

The geological characters of this section will be described directly.

Early in April, 1911, and soon after this work had begun, there appeared in the daily Press notices that skeletons, presumably those of aboriginals, were being exposed in the course of the removal of the earth, and, on the 5th of the month, intimation was received at the Museum from Mr. A.

White, Assistant Superintendent of the Works, to the effect that bones were then being met with in considerable numbers. He advised also that as some of them were being thoughtlessly or wilfully damaged it would be desirable that steps should be taken to secure them. Accordingly Mr. F. R. Zietz was instructed to go to the locality on the following morning to act on behalf of the Museum.

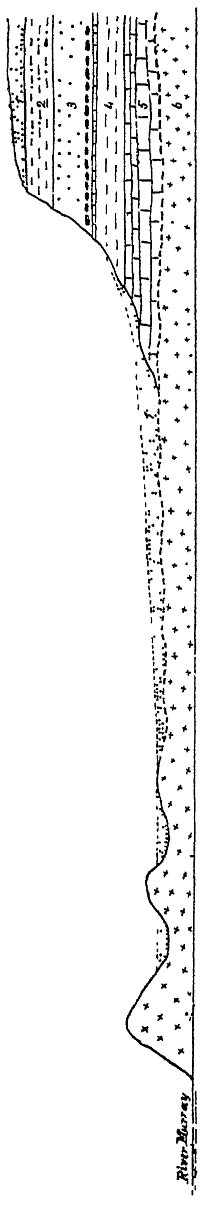
On reaching Swanport he found that a large number of bones had already been exposed, most of them having been promiscuously thrown into a hole, while others had been shovelled with the soil into the trucks and tipped on to the embankment Mr. Zietz, who was present on the spot during a part of April 6 and during the whole of April 7 and 8, with the assistance of Mr. White and of Messrs. Bott, sen. and jun., rescued as many as possible of these bones, but owing to the indiscriminate way in which they had been treated the individual identity of all the skeletons so handled was unfortunately lost. During Mr. Zietz's stay, however, other skeletons were exposed as the cutting advanced, but never in such numbers as before his arrival; but these, however, he was able to secure more or less completely.

I visited the locality myself for the first time on April 14, when the cutting had advanced about 25 yards from its beginning. The length of the exposed section was then about 50 yards and its height, at the centre where it was highest, about 6 ft., and, from what has been said of the contour of ground, it will be understood that the height of the section gradually diminished to vanishing point towards either end.

The face of the section showed the following features:— The top layer was the undisturbed, rather sandy, surface soil, about 8 in. to 1 ft. thick where it was intact, though most of this had been previously scraped off by the scoop Below this was a dark, in parts almost black, layer about 18 in. thick. Its basis was sand, with which were intermixed immense quantities of mussel *(Unio)* shells, broken into small fragments, with some unbroken valves, ashes, and fragments of limestone blackened by fire. A few hammerstones were also found in this layer (plate v.).

This extensive, dark layer covering the whole section evidently formed a great accumulation of kitchen-midden material, indicating long usage as a camping-ground.

Underlying the above was a layer of reddish sand from 2 to 3 ft. thick (plate v.), descending into which were occasionally seen extensions of the material of the kitchen-midden layer. At the bottom of such leads bones were usually found, thus showing that such had been buried after the accumulation of some, at least, of the kitchen-midden



SECTION OF BEDS AT SWANPORT WHERE THE REMAINS OF ABORIGINES WERE FOUND.

1. Surface soil (sandy). 2. Dark sand with remains of kitchen-midden material, thickness, 1 ft. 6 in. 3. Reddish sand containing small pockets and thin lines of broken Unio shells. The skeletons, represented by the horizontal line of elongated black marks, were found near the base of this bed; thickness, 2 ft. 6 in. 4. Travertine limestone above, with calcareous rubble below; thickness, about 2 ft. 5. Calcareous sandstone (Murray Bridge freestone) of Lower Cainozoic age; thickness, 2–3 ft. 6. Bed-rock consisting of massive granite

material, or, in other words, that the site was used as a camping-ground subsequent to these burials. In fact, those who were engaged in the work told me that the presence of such a lead might always be taken as evidence that bones would be found beneath In other parts, generally speaking, the line of separation between the kitchen-midden layer and the subjacent red sand was fairly distinct

Below the red sand was a horizontal band of travertine limestone (plate iv.) varying in thickness from 6 in. to 1 ft, which was of moderately hard consistency towards the northern end of the section, but much softer towards the opposite extremity. Underlying the travertine was a layer of sand and rubbly limestone, the full depth of which was not exposed by the section.

On the occasion of my second visit to the locality on May 4, during which I had the advantage of the company of Mr. Howchin, the cutting had advanced a few yards farther into the rising ground, and its vertical face had consequently increased in height, the increase being due to the exposure of a greater thickness of the layer of sand and limestone rubble beneath the travertine. The superjacent layers were unaltered in their depth or relations. Bones were still being met

with but sparsely, and most of them were in friable condition

GEOLOGY (Figure, p. 7)

For the following description of the site from the geological point of view and for the sketch of the section, here given, I am indebted to Mr. Howchin, F G.S.

The ground in which the remains were found forms a river terrace on the right bank, having an average height of 10 ft. above high-water mark.

The bed-rock of the locality consists of the well-known Swanport granite, which is quarried near by for building purposes. There are large irregular outcrops of this granite fronting the river, at the base of the bank which has yielded the aboriginal skeletons.

Resting on the granite is a layer of calciferous sandstone of Eocene Age (Murray Bridge freestone), having a thickness of 2 or 3 ft.

This calcareous bed has given rise to a layer of imperfectly consolidated travertine limestone about 2 ft in thickness, which at one time formed the surface of the ground. The upper portion of the bed forms an irregular crust, and the lower portion a marly and sandy rubble.

At a later stage, and before the site was utilized as an aboriginal burying-ground, the limestone became covered with blown sand, forming a capping about 4 ft. in thickness on the limestone. This deposit of sand is divided into two very distinct portions—the lower 2 ft. 6 in. consists of clean red sand with small pockets and thin layers of broken Unio shells, while the upper 1 ft. 6 in. is a dark-coloured sand mixed with black pellets of travertine limestone and a large quantity of Unio shells broken into by small fragments.

The red colour, present in the lower portions of the sand-bed, is a characteristic feature of deposits of this nature, in all arid climates, when left for a long time undisturbed The colour is caused by the presence of iron oxide carried down by the rain-water from the surface, as a mineral residue from the decomposition of vegetable organisms When exposed to the weather and blown by the wind the sand loses this colour by friction and bleaching.

The upper part of the sand-bed has taken its dark colour from the fires made by the aboriginals on the spot. The charcoal and ashes from the fires, as well as a certain amount of animal refuse, became mixed with the superficial sand, imparting a dark colour to it. The considerable thickness of this deposit, besides the large quantities of broken Unio shells in the kitchen-midden, gives evidence of a prolonged occupation of the site.

The presence of man is indicated contemporaneously with the building up of the lower portions of the sandhill by the pockets and thin layers of Unio shells referred to above, but only as an occasional visitor. It seems probable that the utilization of this ground as a burying-place was long anterior to its becoming a regular camping-ground, as it is not likely that the aboriginals would bury their dead where they lighted their camp fires. There seems to be three successive periods indicated by the section:—*(a)* An early evidence of man's presence before the period of many burials, when he occasionally visited the spot and ate his meals; *(b)* a period of crowded burials in which the sandhill became disturbed by digging graves; *(c)* a comparatively late period, when probably the remembrance of the burials had passed from the mind of the local tribe, as shown by the selection of this site for a camp, which must have been frequently visited.

Position and Attitude of the Skeletons.

Unfortunately that part of the ground in which the skeletons occurred most numerously and in closest juxtaposition had been disturbed by the workmen before the arrival of Mr. Zietz on the field. Bones and earth had been picked down together in a confused mass, and in consequence, so far as these skeletons were concerned, both the identity of individuals and the opportunity of noting their positions and attitude were lost. As already stated, Mr. Zietz rescued as many as possible of the bones that had been previously removed under such unfavourable circumstances, and he was able, also, to take care that those subsequently exposed were removed with proper precaution. The skeletons, however, never again occurred in such remarkable profusion as before his arrival.

Fortunately Mr. J. T. S. Bott, a resident in the locality for many years, was present from the time of the first exposure of the bones, and for what I have to say under the present heading I am chiefly indebted either to his information or to the observations of Mr. Zietz, who, though coming later on the scene, made the best use of his opportunities. The great bulk of the bones were found at the level of the bottom of red sand, lying just above the travertine band, and the majority were concentrated within an area of about 50 x 30 ft., situated a little to the south of the centre of the rise. In the case, however, of one skeleton that was removed during my first visit—and there were a few others of which the same may be said—the hole made for their reception had penetrated the travertine, and the bones lay at this level or even partly below the latter. At this place the travertine

was very soft and presented little obstacle to penetration, while a little farther to the north it was of harder consistence. Such a position, however, was quite exceptional, and the great bulk of the bones lay, as stated, just above, or on, the band of travertine, which was about 4 ft. below the surface of the ground. Mr Zietz further noted that the bones found at the lower part of the slope were in a much better state of preservation than those found farther away from the river, which might indicate a later date of interment in the former position, but he also remarked that bones found resting on the travertine were liable to be decomposed, owing probably to the continued action of water, to the drainage of which this more impervious stratum presented an obstacle.

As regards attitude, the majority of the skeletons were found in the trussed position in which many Australian tribes bury their dead—that is to say, the body was in a sitting position with the knees drawn up to the chest, the elbows bent so that the hands are brought up to the face, and the head bent forwards over the flexed knees. Sometimes in this trussed position the body lay on one side. In some instances, as was the case with the skeleton exposed during my first visit, the body had apparently been thrown into the grave anyhow; none were seen lying stretched out straight in the supine position. In only a few instances two, but not more than two, skeletons lay in one hole, and in some of these cases they were those of an adult and child. Even where the bodies lay in closest juxtaposition they had still apparently been buried separately.

Not infrequently the skull and other bones were found covered with a tenaciously adherent black encrustation, as if from prolonged exposure to smoke, and in some cases the surface of the bones had been charred, or, even, the whole thickness destroyed. In several instances, as indeed in the skeleton I saw removed, the cranium—usually so conspicuous an object in an exhumation—could not be found after the most careful search, though in this particular case a lower jaw of remarkable size was present. Once, the cranium being absent, two lower jaws were found accompanying the rest of the skeleton. Very frequently the small bones of the foot and hand were absent, and the remaining bones did not occupy their proper relative positions, and occasionally the long bones of the extremities were found broken.

Many of the conditions and deficiencies just recorded can be accounted for by the burial custom of the Narrinyeri tribe, to which the natives of this locality belonged. It was their practice, among other elaborate procedures, to place the bodies of their dead upon a platform and subject them

to a prolonged process of smoking over a slow fire. This will explain the blackening and occasional charring of the bones

Mr. Taplin, in his account of the Narrinyeri in "Native Tribes of South Australia" (**1**, 20),[1] describes this smoking process, but says nothing as to subsequent burial. In his "Folklore," etc (**2**, 37), he mentions that at the conclusion of the long smoking and drying process the body "was put on a stage in a tree and after a time buried." How long it was left on this tree platform before burial Mr. Taplin does not say, but I know that it was sometimes left in this position for years—so long, in fact, that it would seem as if no further disposal of it had been intended. This, however, may have been because of the discontinuance of their proper native customs due to the influence of the whites.

In the course of this long exposure, as I have repeatedly seen, the small and easily detached bones, such as those of the feet and hands and, even, the lower jaw, were apt to fall to the ground or be removed by carrion-eating birds, and, if afterwards the bones were buried, it can be easily understood how some of them should be missing and others relatively displaced.

The not infrequent absence of the cranium, which, from its size, is not likely to have disappeared in this fashion, may not unreasonably be accounted for by the practice among the Narrinyeri, as indeed among some other Australian tribes, of utilizing skulls as vessels for carrying water [2]

Of the bones found broken it is possible that the more fragile ones might have been fractured by rough usage such as dropping them, or the body, into a deep hole; but this would scarcely account for the fracture of such strong bones as those of the thigh, which, also, were not unfrequently found broken into two or more pieces. Some of these frac-

[1] The figures, within brackets, occurring in the text refer to the bibliography at the end. The first figure in heavy type corresponds to the number of the work referred to and that in lighter type to the page. Where it is necessary to indicate a particular volume its number will be expressed by a Roman numeral interpolated between the former two.

[2] Unfortunately this interesting form of utensil is represented in the National Museum only by a cast, for which it is indebted to the Australian Museum, Sydney; the original, in the possession of that institution, having been obtained on the Coorong, South Australia. This is an example, of which many others might be given, of how interesting and sometimes unique relics have, from want of proper foresight, been allowed to leave the country of their origin.

tures may have occurred during life and have formed the injury, or a part of the injuries, causing death, for it is evident, as shown by a considerable number of the bones, that broken limbs were not uncommon. Some of these fractures had become united so satisfactorily that the resulting union would have done credit to a skilled surgeon In other cases the union, though very strong, had taken place in bad position. There was nothing in the character of the fractures of the exhumed bones to suggest that they had been broken for the purpose of obtaining the marrow

Associated with the human remains that were collected, after the promiscuous removal of those first met with, were bones of the dingo, including a perfect skull, and odd bones of the kangaroo, opossum, bustard, pelican, turtle, and fish,[3] and a closer examination of the remains may possibly reveal the presence of bones of other animals Whether these had been actually buried with the human remains or, belonging properly to the kitchen-midden layer, had accidentally become mixed with the latter cannot be stated with certainty. A few articles of human manufacture were also found in like association with the skeletons, viz., some hammer and anvil stones, one small quartzite implement which may have been used as an engraving or boring tool, two awls made from kangaroos' fibulæ, a few stone chips and a few blackened stones that had been used for cooking No emu remains have been so far identified, and not a single fragment of iron, glass, pottery, or other white man's material was seen.

Resting immediately over a few—but only a very few—of the skeletons were large oval slabs of a composite material of the consistency of soft and friable mortar, and composed of sand, white earth, small fragments of limestone, burnt clay, broken Unio valves, and, occasionally, pieces of charcoal. The largest of these slabs was 1 ft. 9 in. x 1 ft. 3 in., and 5 in. thick at the thickest part; another was 1 ft. 3 in. x 12 in. x 3 in. Fragments of others were also found. From their composition they are evidently of artificial origin, but as to their significance in relation to the interments I am unable to speak. They may, however, come into the same category as the "widows' caps," actual or conventional, that were placed in the graves by the natives higher up the river, or the "Kopai" stones similarly used in the Darling River district.

(3) It is curious that so few remains of fish were found when we remember that it is a favourite food of the natives and that the adjacent river abounds with them.

The Narrinyeri Tribe (4)

As this tribe has been mentioned in connection with the remains found at Swanport and will be further noticed it may be convenient to give some particulars as to its geographical distribution.

According to Mr Taplin (**1**, 1 and **2**, 34) this tribe inhabited a large, triangular tract of country bounded on two sides by lines drawn from a point 20 miles above Wellington to Cape Jervis and Kingston respectively, and on the third side by the sea. Having thus an immense frontage to the fresh waters of the river and lakes and to the salt waters of the ocean and Coorong, they were exceptionally well favoured in the matter of food supplies. As Swanport is, in a direct line, about 15 miles above Wellington it stands nearly at the northern apex of the Narrinyeri territory. The tribe was divided into eighteen local divisions or clans, each having its own geographical distribution, and, collectively, they formed a powerful body whose numbers, in 1840, Mr. Taplin reckoned at 3,000 individuals, though he gives no grounds on which his estimate is based. The many camping- and burial-grounds that are found all along the shores of the lakes and river are, however, quite indicative of a numerous population.

On the north, east, and south their neighbours were the Moorundie, Adelaide, and Tatiara tribes respectively.

The Narrinyeri have some historical interest, as it was members of this tribe who were concerned with the death of Captain Barker at the Murray Mouth in 1831, and with the murder of the shipwrecked passengers and crew of the "Maria" at Lacepede Bay in 1840. It is the remnants of this once numerous tribe, now chiefly half-castes, that form the population of the Point Macleay Mission Station, or that lead a nomadic existence along the lake and river shores. A few have a more or less permanent camp at Brinkley below Wellington, on the left bank of the Murray just before it enters the lake.

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(4) Though the word Narrinyeri is, according to general custom used here as a tribal designation it really has not this significance, as Mr. Taplin has explained (**1**, 1). According to this writer the term properly signifies "belonging to men," meaning that this people considered themselves *par excellence* as men in contradistinction to other natives whom the Narrinyeri considered as inferior beings.

An old blackwoman, to whom further reference will be made, implied that the term signified the native race generally, and she spoke of the subdivisions of the Narrinyeri as separate tribes, but she could hardly be considered as an authority on ethnological terminology.

Previous History of Swanport.

Mr. Bott, whose name has been mentioned in connection with these remains, has been a resident at Swanport for the last thirty years. His predecessor lived there one year, and before him, again, was a resident of twenty years' standing. This takes us back for a period of fifty-one years or to 1860. During the whole of that time the fact that the place had been used as a native burial-ground was completely unknown to any of the residents, and, certainly, no interment had taken place during those years, though, since the memory of the white man, it has been constantly used as a favourite camping-ground.(5)

If, therefore, some of the interments took place after the great accumulation of the kitchen-midden material—and that this happened in some cases at least is shown by the leads of this layer into the subjacent sand—it betokens a very ancient occupancy of the site.

Monteith

Before passing on to the consideration of the question whether the presence of so many skeletons in one limited area is due to any special cause, I may mention that, on the occasion of my second visit to Swanport, I was able to examine a spot about 1½ miles lower down the river, on the left bank, where I was informed that many skeletons had been exposed by the drifting of sand some years ago

The site was at the top of a high sandy bluff which, pushing itself right up to the river bank, separates the reclaimed flat, formerly known as Monteith's Swamp, from an unnamed and unreclaimed swamp to the north of it. From the facts of its exposed situation, the sandy nature of the ground, and the thriftless way in which it has been denuded of vegetation 5 or 6 ft. of the superficial soil has been blown away to accumulate elsewhere as drifts over a considerable area, leaving exposed the underlying surface of indurated sand. On this floor, and over a considerable area, occur very numerous and, sometimes, very large heaps of broken Unio shells and many blackened cooking-stones, indicating long occupancy by the natives. The age of these cooking-stones was indicated by the fact that their surface had become

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(5) For some years a ferry-boat service was maintained at Swanport (formerly known as Thompson's Crossing), and in the course of the removal of the bank it was found that the lower end of a buried portion of one of the wooden slabs used in the construction of the ferryman's house had come into close contact with a skeleton. The house was, in fact, built right upon the burial site, and some of its chimney-stones still remain upon the spot (see plate iv.). The native name of the locality was Kongorong (**31**, 123).

almost polished by the long action of driven sand. No human bones, however, were visible, though a hammer- and an anvil-stone and a few quartzite flakes and chips were found

Mr. Bott told me that when, some years ago, he saw the recently exposed skeletons they were lying in a row side by side

The Alleged Pandemic

From what has been said the actual manner of disposal of the bodies at Swanport affords no conclusive evidence of the incidence of some sudden and great mortality among the natives, of such a catastrophic character as would cause them to substitute a more hurried method of burial for their ordinary mode of interment, and although the facts that two bodies were sometimes found buried together, and that others seemed to have been thrown in without care, may be taken to show that sometimes all may not have been quite in order, there was, at least, no sign of such promiscuous and collective burial as occurred in the "plague pits" of the mediæval epidemics of Europe. The number of bodies represented by the remains, apart from the fact that it does not constitute a record (**3**, 1., 217), is not of itself conclusive, for the accumulation in this one place may be explained equally well on the assumption that it may have been, and probably was, used as a burying-ground for a very long period of years; and, moreover, if some sudden and great mortality did actually occur in the district there is no evidence to show that Swanport, more than any other of the numerous burying-grounds along the river, was a special place of sepulture for the victims of the supposed malady. In any case Swanport was, no doubt, only one of many which would have been put to a similar use in a great emergency

Nevertheless there is such an accumulation of evidence that not only the Narrinyeri, but many other of the native tribes were at some time, and possibly on more than one occasion, smitten with an epidemic disease of great virulence and destructiveness that it may be of some interest to present the available information bearing on the subject. In the inquiry it will be necessary to investigate the origin and nature of the disease and the course taken by it in its spread throughout, as we shall see, a large part of Australia.

Unfortunately for such an inquiry, the living persons who are old enough to have spoken with natives who were themselves alive at the time of the occurrence of the supposed epidemic are few in number. Most of the old pioneers are dead, and so are most of the aboriginals who, though they might not be old enough to have lived at the time of its supposed occurrence, might yet have heard of it from eye-witnesses

Still, as I shall show, some evidence of this kind is fortunately yet available. Mr. Bott, whose long residence of thirty years at Swanport has been mentioned, informs me that in his early days three old blacks were living in the district, viz , Billy Poole, Jimmy Giles, and Jimmy Duck. Their names are still well remembered by old colonists. Billy Poole was the eldest of the three and was, at the time of which Mr. Bott speaks—that is, about 1880 or 1881—probably seventy years of age. Assuming this estimate of age to be correct Billy Poole's personal recollections might have gone back to about the year 1815. These old blacks, Mr. Bott told me, often spoke to him about a great sickness which, when they were quite young, fell upon the natives along the river, causing their deaths in such numbers and with such rapidity that the living were at their wits' end to know how to dispose of the dead quickly enough; and they also described how in the sickness they came out all over spots and quickly died, the rapid onset of decomposition after death, and their unavailing efforts to find an effective remedy among the plants of the scrub.(6)

This evidence does not enable us to fix the time of the occurrence, except to the extent that it was certainly before the coming of the white man as a permanent settler.

There is still alive and in full possession of all her faculties an unusually intelligent old woman of the Narrinyeri tribe, well known to all the inhabitants of the Lake Districts, who has often told me an unvarying story of her first sight of the white people. It occurred to me that she might have some recollection of the great sickness, and accordingly I sought an interview with her at Wellington West on May 21. She had been camping on Poltalloch Station, on the south side of Lake Alexandrina, but she readily came to the place mentioned when told that I wished to see her.

This old black's married name, under which she is generally known, is Mrs. Karpeny,(7) or Louisa Karpeny (plates vi., vii., viii.), but her own proper name is Köntinyeri (the exact vowel sound of the first syllable being represented by the German modified o). She has, or has had, two sons and six daughters and twenty-eight grandchildren. She spends her life wandering from place to place along the shores

(6) Or, as Billy expressed it, "Long time ago big one sick; big one tumble down all about 'long river; die very quick; can't bury quick enough; big one very quick stink, blackfellow big one frightened; all run away."

(7) In the pronunciation of this name the accent is upon the first syllable and the second is short.

of the Lower Murray and lakes from Wood's Point to Point Macleay, sometimes camping for varying periods on the stations and sometimes staying at a native camp at Brinkley. In her younger days she was often employed on the stations at shearing-time, and she told us how much better than the white men she and other natives did their work in the woolsheds.

Mrs Karpeny related her reminiscences with much dramatic vividness, and as they are interesting in themselves I will make no apology for giving them at some length. even when they refer to other matters than the immediate object of my inquiry

On the occasion of our interview she told how, when she was quite a little girl and encamped with others of the tribe on what is now Poltalloch Station, she and her young brothers and sisters were much alarmed at the sight of two soldiers in red coats, and another man, on horseback, one of the soldiers having a "feather sticking out of his hat." In their fear the children went into the water and stood, hidden, among the reeds until the soldiers had passed out of sight. This could not have been before December, 1836 (the date of the proclamation of the colony), but it was probably not long afterwards, for, according to her story, this episode occurred some time—she thought two or three years—before the wreck of a ship (the "Maria") which occurred in 1840. Though living at Poltalloch at the time, which place, however, is not a great distance from the Coorong, when the episode took place, she seemed to know all about the affair, the natives concerned in it, and the punishment inflicted upon some of the supposed participators in the murder of the crew and passengers, for she related, with much circumstantial detail, that two of the natives were hanged and two shot, a statement which agrees with that given by Mr. Taplin (1, 5). At that time she said, indicating her height, she was "quite a big girl," about ten or twelve years of age, as she thought.

Then, on being questioned, she spoke of the coming of the great sickness which she called small-pox. She said it occurred some time before the episode of the white soldiers, and that she was a very little child at the time.

Now, assuming that Mrs. Karpeny was of the age she stated at the time of the "Maria" incident, she would have been about seven when she saw the white soldiers—which, as we have said, could not have been before 1837; and if she were actually alive at the time (a point on which she insisted) it would fix the date of the epidemic at not earlier than 1830—a date which it is important to remember—and

her own age at not less than eighty, which I think is not at all improbable.

If this be approximately the date of the epidemic of which Mrs Karpeny was a witness as a child it was, as we shall see, some years later than that which we must assign to the one of which Mr. Taplin speaks in his account of the Narrinyeri, to which I shall refer directly. But Mrs. Karpeny was quite certain that the sickness of which she spoke was the only one that occurred during her lifetime, nor before that occurrence had she ever seen any blacks marked with the disease, though afterwards there were many such.

This old black spoke of the coming of a strong *west* wind which made the reeds all tremble, and this, she said, was taken as a sure sign that the sickness was coming—which it did very quickly. In making this statement, which she repeated two or three times with great earnestness, she held out her two hands and made them quiver. With much gesture she described how the faces of those affected with the disease came out all over spots, and how that many died of it, including many children. She herself escaped, but her aunt, who is still living,[8] and who, she says, is considerably older than herself, caught the disease and has her face marked. She told of the remedies they sought, one being young reed shoots pounded and administered from a mussel *(Unio)* shell used as a spoon; another was the boiled leaves of mallee eucalypts gathered in the scrub. She also mentioned the use of other plants which I could not identify, but which she said she could point out. Nothing, however, did any good. Several of these statements were repeated two or three times, and always with adherence to the same version.

When asked whether they buried those who had died of the sickness she said, "No; we smoked 'em," and that led me to ask her about the ante-burial rites of the Narrinyeri. Her replies conformed to the account given by Mr. Taplin, but she gave more explicit information about the subsequent and final interment, stating that the bones were put into the ground two or three years after they had been finally placed on the platforms.

She had never been as far up the river as Swanport, and knew nothing of the burials there.

Bearing in mind the frequent absence at that locality of the cranium from the other parts of the skeleton, I asked Mrs. Karpeny whether, in her young days, it was a common custom to convert the skulls into drinking vessels. She said it was, and that she herself had often carried two of them.

[8] Since these lines were written this old woman has died. She will be again referred to.

She described, without any hesitation, how they took the skull from a platform ("knocked off the head" were her actual words) and put it to soak in the water until freed from the soft parts; and when cleaned they carried it about by means of a handle made of string. "Lots of 'em," she said, were used in this way. This statement affords a satisfactory explanation of the missing crania at Swanport.

Mrs. Karpeny knew the three old blacks mentioned by Mr. Bott, and reminded me of a forgotten episode in which one of them had taken charge of my brother and me as boys. She also named several other natives who were well known round the lakes in the early days.

From Mr. Paul Martin, now of Appila-Yarrowie, I have also some information on the same subject. He writes me, under date May 17, 1911, to the effect that he went to live in Strathalbyn about 1845, being then about eight or nine years of age. He remained there until 1852, when he went to the Victorian gold diggings. Returning afterwards to South Australia he went to live on the lower Finniss. There he saw many pock-marked blacks, and one of these—an intelligent man of about thirty or thirty-five—told him that when he was a little boy "big one wind" came from the *east* (cf. Mrs. Karpeny's account *ante*): then, pointing to his marked face, "this one come." He also said that many blacks in the district were affected and that many died. It is striking that in the accounts given by both Mrs. Karpeny and Mr. Martin's informant the coming of the sickness is associated with a strong wind, though the direction given in the two statements is diametrically opposite. In this respect Mrs. Karpeny's statement is an exception, for most of the statements speak of the disease as coming from the east.

Turning now from the oral to the written evidence bearing on the subject, and, first, as it relates to the Narrinyeri, the Rev. George Taplin, writing in 1874 (which is the date of the first edition of his account of this tribe), says (**1**, 44):— "They have a tradition that some sixty years ago a terrible disease came down the River Murray, and carried off the natives by hundreds. This must have been small-pox, as many of the old people now have their faces pitted who suffered from the disease in childhood. The destruction of life was so great as to seriously diminish the tribes. The natives always represent that before this scourge arrived they were much more numerous. They say that so many died that they could not perform the usual funeral rites for the dead, but were compelled to bury them at once out of the way. I think there must have been more than one visitation of this kind, judging from the age of those who are pock-marked."

In this writer's "Aboriginal Folklore" (**2**, 45) he makes the same reference, with the omission of the period at which the disease is supposed to have occurred. Assuming, however, the epidemic of which he speaks to have occurred at about the time referred to in the first-mentioned account the approximate date of its occurrence would be 1814 or thereabouts, or more than twenty years before the foundation of the colony

Mr. Howitt, also (**4**, 195), speaks of certain propitiatory rites as having been proposed by certain riverine tribes to avert the consequences of a great sickness that they heard was coming down the Murray, and there are other statements to the same effect to which reference will be made later. What has already been said, however, is sufficient to establish, as a starting-point for my inquiry, the fact that at some time prior to the arrival of the white man the natives of the Lower Murray were afflicted with a pestilence of great fatality, and that the Murray riverine system formed a principal channel for its transmission. What the pestilence was and how it originated we shall have also to inquire.

Origin of the Disease.

Had there existed any evidence of the existence of disease, a widely-spread disease such as small-pox, among the Australian aborigines before the first colonization settlement in New South Wales in 1788 its presence, or its past effects, would probably not have escaped the notice of the earliest voyagers such as Dampier and Cook. The former came intimately in contact with a particular tribe on the north-west coast of what is now Western Australia and gave many details of them, for the most part of an uncomplimentary nature (**24**, I., 464); while Captain Cook, at different times, saw a good many natives and wrote concerning them, but neither of these travellers make any mention of any characteristic affection such as that of which we are speaking; indeed, the latter traveller expressly states that he saw no marks of disease or sores upon their bodies (**25**, III., 634). There is also no evidence to show that any disease was communicated to the natives by the white sailors of either expedition.

The circumstances and possible influence of two subsequent expeditions to Australia will require a closer scrutiny. The first of these was that of the English fleet which brought the first convicts to the then newly-founded settlement of New South Wales. This was under the command of Captain Arthur Phillip (who subsequently became the first Governor of the colony), with Captain John Hunter as second in com-

mand The expedition arrived in Botany Bay in January, 1788, and shortly afterwards moved to Port Jackson. Of the circumstances attending the start of this expedition it will be necessary to speak further.

Five days after these English ships had reached Botany Bay two French frigates, the "Boussole" and the "Astrolabe," under the command of La Pérouse, arrived at the same harbourage, and in the March following sailed away, to be lost with all hands, as was subsequently discovered, on one of the islands of the Santa Cruz group.

There are good grounds for excluding from suspicion the crews of the French ships as the source of any communicated disease. A perusal of the account of the voyage (**5**, I.) will show that the expedition was fitted out with great care and foresight, and that in the instructions to the commander a whole chapter is especially devoted to the precautions which are to be taken in order to preserve the health of the crews (**5**, I., 55). That these were effectually carried out may be gathered from the statement, several times repeated, that there was no sickness on board, and in a letter written by La Pérouse on February 4, 1788 (**5**, IV , 201), after his arrival at Botany Bay, he says:—"Nous sommes arrivés à la nouvelle Hollande sans qu'il y ait eu un seul malade dans les deux bâtiments." These facts will sufficiently establish the freedom from disease of the sailors of the great French navigator, and we may dismiss them from suspicion as propagators of disease of any kind.

In April, 1789, *fifteen months after the departure of the English ships and thirteen after that of the French,* no other ships having visited the locality meanwhile, a virulent and fatal epidemic was found to be raging among the natives living round the shores of Port Jackson. The event is thus described by Colonel David Collins, Judge-Advocate and Secretary of the colony (**6**, 65):—

"April.—Early in the month (1789), and throughout its continuance, the people whose business called them down the harbour daily reported, that they found, either in excavations of the rock, or lying upon the beaches and points of the different coves which they had been in, the bodies of many of the wretched natives of this country. The cause of the mortality remained unknown until a family was brought up, and the disorder pronounced to have been the small-pox. It was not a desirable circumstance to introduce a disorder into the colony which was raging with such fatal violence among the natives of the country: but the saving the lives of any of these people was an object of no small importance, as the knowledge of our humanity, and the benefits which we

might render them, would, it was hoped, do away the evil impressions they had received of us. Two elderly men, a boy, and a girl were brought up, and placed in a separate hut at the hospital. The men were too far overcome by the disease to get the better of it; but the children did well from the moment of their coming among us.

'From the native who resided with us we understood that many families had been swept off by this scourge, and that others, to avoid it, had fled into the interior parts of the country. Whether it had ever appeared among them before could not be discovered, either from him or the children; but it was certain that they gave it a name (gal-gal-la); a circumstance which seemed to indicate a previous acquaintance with it. . . .

"May.—Of the native boy and girl who had been brought up in the last month, on their recovery from the small-pox the latter was taken to live with a clergyman's wife, and the boy with Mr. White, the surgeon, to whom, for his attention during the cure, he seemed to be much attached.

"While the eruptions of this disorder continued upon the children, a seaman belonging to the 'Supply,' a native of North America, having been to see them, was seized with it, and soon died; but its baneful effects were not experienced by any white person of the settlement, although there were several very young children in it at the time.

"From the first hour of the introduction of the boy and girl into the settlement it was feared that the native who had been so instrumental in bringing them in, and whose attention to them during their illness excited the admiration of everyone that witnessed it, would be attacked by the same disorder; as on his person were found none of these traces of its ravages which are frequently left behind. It happened as the fears of everyone predicted; he fell a victim to the disease in eight days after he was seized with it, to the great regret of everyone who had witnessed how little of the savage was found in his manner, and how quickly he was substituting in its place a docile, affable, and truly amiable deportment."

The same writer again refers, with a few additional but not essential details, to the outbreak in a chapter dealing with the disease of the natives (p. 596).

In the foregoing account the following points are of importance and will be further noticed:—

1. The long period—fifteen months—elapsing between the departure of the English ships and the outbreak of the disease, or, in the case of the French, thirteen months.

2 The pronouncement presumably either made or acquiesced in by the chief medical officer to the settlement (Surgeon-General White) that the disease was small-pox

3. That neither the whites, generally, nor the white children were affected, and that while the two native adults died of the disease the two affected children recovered

Captain Hunter (**7**, 132) also gives an account of the outbreak which is assumed to be small-pox, and it is again alluded to by Barrington (**8**, 31) "as a disorder in appearance like the small-pox," and similarly by Tench (**9**, 18 and 27).

These are the earliest references to this outbreak, made by those who were living in the settlement at the time of its occurrence, and they leave no doubt of the main fact, viz., that in 1789 the natives of the locality became smitten with a virulent malady that was either small-pox or so like it as to be readily taken for it

At this stage, and before tracing the further progress of the disease, we must return more particularly to the question of its mode of origin. We have seen that there are no grounds for attributing its source to the French sailors, whose ships show an exceptionally clean bill of health right up to the shores of Australia. There remains, then, for further consideration the English ships, and it becomes necessary to examine their health record more minutely from the commencement of their voyage

The facts in this connection are recorded by John White, Surgeon-General to Captain Phillip's expedition and, afterwards, of the settlement (**10**, 2 *et seq.*), and as their correct interpretation is of such importance I must at some length quote the author's words (the italics are his): —

While the main part of the fleet destined for the new settlement was lying at Spithead previous to sailing it was joined by two additional transports, on one of which was the Surgeon-General, and immediately afterwards "I visited all the other transports, and was really surprised to find the convicts on board them so very healthy. When I got on board the 'Alexander,' I found there a medical gentleman from Portsmouth, among whose acquaintance I had not the honour to be numbered. He scarcely gave me time to get upon the quarter-deck, before he thus addressed me—'I am very glad you are arrived, Sir, for your people have got a *malignant* disease among them of a most dangerous kind; and it will be necessary, for their preservation, to get them immediately released.' Surprised at such a salutation, and alarmed at the purport of it, I requested of my assistant, Mr. Balmain, an intelligent young man, whom I had appointed to the ship for the voyage, to let me see the people

who were ill 'Sir,' returned Mr. Balmain, taking me aside, 'you will not find things by any means so bad as this gentleman represents them to be: they are made much worse by him than they really are Unlike a person wishing to administer comfort to those who are afflicted, either in body or in mind, he has publicly declared before the poor creatures who are ill, that they must inevitably fall a sacrifice to the malignant disorder with which they are afflicted; the malignity of which appears to me to exist only in his own imagination I did not, however,' continued Mr. Balmain, 'think proper to contradict the gentleman; supposing from the consequence he assumed, and the ease with which he had given his opinion, or more properly *his directions*, that he was some person appointed by the Secretary of State to officiate for you till your arrival When you go among the people you will be better able to judge of the propriety of what I have said.' Mr. Balmain had no sooner concluded than I went between decks, and found everything just as he had represented it to be. There were several in bed with slight inflammatory complaints; some there were who kept their bed to avoid the inconvenience of the cold, which was at this time very piercing, and whose wretched clothing was but a poor defence against the rigour of it; others were confined to their bed through the effects of long imprisonment, a weakened habit, and lowness of spirits; which was not a little added to by the declaration of the medical gentleman above mentioned, whom they concluded to be the principal surgeon to the expedition. However, on my undeceiving them in that point, and at the same time confirming what Mr. Balmain had from the first told them, viz., *that their complaints were neither malignant nor dangerous*, their fears abated."

The Surgeon-General then goes on to say that he informed the patients that he would give orders for the supply of clothing to those who were in want of it, and that as they had been nearly four months on board on a diet of salt provisions he would endeavour to get some fresh for them while in port. "This short conversation had so sudden an effect on those I addressed, and was of so opposite a tendency to that of the gentleman alluded to, that before we got from between decks, I had the pleasure to see several of them put on such clothes as they had, and look a little cheerful. . . .

"On returning to the quarter-deck, I found my new medical acquaintance still there; and before I could give some directions to Mr. Balmain, as I was about to do, he thus once more addressed me—'I suppose you are now convinced of the dangerous disease that prevails among these people, and of the necessity of having them landed, in order

to get rid of it.' Not a little hurt at the absurd part the gentleman had acted, and at his repeated importunity, I replied, with some warmth, that I was very sorry to differ so essentially in opinion from him, as to be obliged to tell him that there was not the *least appearance* of malignity in the disease under which the convicts laboured, but that it wholly proceeded from the cold; and was nearly similar to a complaint then prevalent, even among the better sort of people, in and about Portsmouth. Notwithstanding this, he still persisted so much in the propriety of their being landed, and the necessity there was for an application to the Secretary of State upon the occasion, that I could no longer keep my temper: and I freely told him, that the idea of landing them was as improper as it was absurd. And, in order to make him perfectly easy on that head, I assured him, that when any disease rendered it necessary to call in medical aid, he might rest satisfied I would not trouble *him*; but would apply to Dr. Lind, Physician to the Royal Hospital at Hasler, a gentleman as eminently distinguished for his professional abilities as his other amiable qualities; or else to some of the surgeons of His Majesty's ships at Portsmouth Harbour, or at Spithead, most of whom I had the pleasure of knowing, and on whose medical knowledge I was certain I could depend."

The Surgeon-General subsequently adds that notwithstanding the salutary effect on the patients of a change of diet to fresh beef and vegetables, with the addition of some wine and other necessaries, "the report of a most malignant disease still prevailed; and so industriously was the report promulgated and kept alive by some evil-minded people, who either wished to throw an odium on the humane promoters of the plan, or to give uneasiness to the friends and relations of those engaged in the expedition, that letters from all quarters were pouring in upon us, commiserating our state. The newspapers were daily filled with alarming accounts of the fatality that prevailed among us; and the rumour became general, notwithstanding every step was taken to remove these fears, by assurances (which were strictly true) that the whole fleet was in as good a state of health, and as few in it would be found to be ill, at that cold season of the year, as even in the most healthy situation on shore. The clearest testimony that there was more malignity in the report than in the disease, may be deduced from the very inconsiderable number that have died since we left England; which I may safely venture to say is much less than ever was known in so long a voyage (the numbers being proportionate), even though not labouring under the disadvantages we were subject to, and the crowded state we were in."

It is to be noticed that, in addition to overcrowding, the conditions under which the convicts made their voyage were evidently very insanitary, for we are told that the Surgeon-General proposed white-washing, with quicklime, those parts of the ships where the convicts were confined, as a means for correcting and preventing the "unwholesome dampness which usually appeared on the beams and sides of the ships, and was occasioned by the breath of the people." Here are, at all events, favourable conditions for the development and spread of disease.

Whatever may have been the exact nature of the "malignant disease" of the unnamed Portsmouth doctor there is other evidence to show that all was not quite right at the start from a health point of view, for Tench (**11**, 1), in speaking of the long stay of the ships at the Motherbank, says:—"In this period, except a slight appearance of contagion in one of the transports, the ships were universally healthy and the prisoners in good spirits." Note here, again, the dominant idea of contagion. Now, while a certain amount of difference of opinion between doctors is unfortunately not unusual, at the present time of improved medical knowledge, one is scarcely prepared to find, even in those days, so great a divergence as appears to have existed in this case Between a disease, thought to be characterized by malignity, and the effects of cold, aggravated by malnutrition, close confinement, and insanitary conditions generally is a wide gulf, and it is impossible to avoid suspicion that the Portsmouth doctor, whose reiterated opinion the official medical officer treated with so much contumely, may have been right after all. Such a suspicion is strengthened by a significant remark made by Tench (**9**, 18), who sailed with the expedition as captain of marines. He is endeavouring to discover the origin of the Sydney outbreak, which he assumes to be small-pox, and, in a footnote, he mentions that "no person among us had been afflicted with the disorder since we had quitted the Cape of Good Hope, seventeen months before." Surely this may be read as equivalent to an admission that the disease had existed in the previous part of the voyage.(9) If this was so it is curious that the principal medical officer (Surgeon-General White) makes no mention of such an occurrence in his account of the voyage, though he alludes to an outbreak of mumps soon after sailing and, later, of dysentery, from which one man died.

It must thus be admitted that strong suspicion attaches to the English expedition as a potential source of some disorder

(9) The fleet arrived at Table Bay on October 13, 1787, and left on November 13. It arrived at Botany Bay on January 20, 1788.

ot a contagious kind, but if that be so the question must be asked why did not the outbreak in Sydney take place until the lapse of so long a period after the arrival of the ships which, under this view, must have contained the germs of the disorder? For, as mentioned, it did not appear until fifteen months after the ships had actually left Sydney or seventeen months after they had left the Cape, since which time there had been, according to Tench's statement, no disease on board.

Mr. Curr (**3**, I, 226) attempts to account for these facts by supposing that the disease emanated from clothes that had become infected on board and had been distributed to the natives. It is well known that disease may be, and is, distributed in this way, even after a long interval has elapsed since the articles were exposed to contagion, and that may possibly be the explanation in this case. Still, under the particular circumstances of the case, one would like to know what was done with the infected clothes during all this long period, which included the time occupied by the voyage from the Cape when the clothes must have been on board and possibly worn. To make the circumstances fit the case one must suppose that these clothes had been put aside, and kept away from human contact, for nearly a year and a half before they were distributed. Otherwise why did not they communicate infection to the white folk who handled, or wore, them in the interval? Or if they were given to the natives soon after the arrival of the ships why did the disease not break out earlier among them?

These are questions that cannot be answered and it would seem impossible to pursue the inquiry further in this direction. We may conclude, therefore, that the Sydney outbreak may have originated from the English ships, but that it is not absolutely proved.

A little later we shall consider another possible origin, also of an extrinsic nature, but before doing so it will be desirable to trace, as far as may be possible, the march of events subsequent to the Sydney outbreak in relation to this or to some similar disease affecting the natives in other parts of Australia.

Subsequent Epidemics.

In this part of my inquiry I am much indebted to an interesting chapter of Curr's "Australian Race" (vol. i., chap. viii.), on the diseases and decline of the aboriginal race, in which the author summarizes all the information he could gain either from published books or from correspondents in various parts of the country. Some details on this subject are also given by Brough Smyth (**28**, I., 253).

The Sydney epidemic occurred, it will be remembered, in 1789; that outbreak appears to have run its course and died out, for, so far as the records are concerned, we hear no more of any similar occurrence until 1830 or 1831, or more than forty years later. About that date an outbreak is reported to have occurred at Bathurst, New South Wales, and at King's Plains, 27 miles west of this place. Under the native word Nguya (pustule) Teichelmann and Schürmann (**12**, 34) add a note to the effect that, about the same date, 1830, a disease (small-pox) was universal among the natives of the Adelaide tribe and diminished their numbers considerably. It is also, there, stated that it came from the east or the Murray tribes. The disease is again reported from Scone, New South Wales, 200 miles north of Sydney, about 1833-5, and from various other places in Victoria or New South Wales between the years 1840 and 1845. Besides these reports, referring to definite outbreaks, the dates of which are approximately fixed, there will be found in the chapter of Curr's work referred to many other statements from people who, writing some years after the actual outbreaks, had seen the blacks bearing pock-marks.

One such reference may be particularly noticed here. It appears that at a date which, according to the context of the letter reporting it (**3**, I., 218), may be put about 1807 smallpox has committed "awful ravages" at Swan Hill, on the Murray.

Farther north Mitchell (**22**, I., 26) records in 1831 an outbreak of which he himself was a witness at Curringài, in the Liverpool Range: and later, in 1835 (**22**, I., 218), he speaks of having seen pock-marked blacks at Fort Bourke and at several other places lower down the Darling, and he alludes to the native population of this river as having been reduced by small-pox. Sturt also (**21**, I., 105) in speaking of the natives of this river, says "that their tribe did not bear any proportion to the number of their habitations. It was evident that their population had been thinned."

It will thus be seen that all the outbreaks, so far mentioned, occurred in eastern and south-eastern Australia; that nearly all of them were among the blacks of the Murray riverine system; and that while most of those of which the dates are definitely stated occurred between 1830 and 1845, one outbreak (Swan Hill) may have occurred as early as 1807. After 1845 the disease seems, if not to have once more disappeared from these regions, to have, at least, subsided in extent and virulence.

In Western Australia Curr records outbreaks of, apparently, the same disease occurring at various localities on

the north-west coast, of which most took place between 1865 and 1870, and he states that as early as 1829 pock-marked blacks were seen in the neighbourhood of Perth (**3**, 219).

According to Foelsche (**13**, 7) small-pox broke out among the natives around Ports Darwin and Essington about 1862 and he makes mention of a plant the juice of which is used as a remedy.

Wilson also in his account of a voyage made in 1828 (**14**, 319) gives in his vocabulary of the Raffles Bay tribe a word, Oie or Boie, for small-pox which shows that they had had, even then, experience of it.

Other references to the existence of small-pox in the Northern Territory about 1865 will be found in Curr's chapter.

That small-pox had existed as far into the interior as Lake Eyre appears from Gason's account of the Dieyerie tribe (**1**, 283), and Foelsche, who knew the natives well, states (**13**, 8) that "no doubt it spread a long distance inland, as pock-marked natives are found among all the inland tribes."

There is evidence also of its presence still farther north, for Mr. Gillen, whose work in conjunction with Professor Spencer on the Central and Northern Australian tribes is so well known, writes me (May 24, 1911) that thirty years ago when he lived at Alice Springs it was a common thing to see old natives pitted with small-pox all along the telegraph line from Charlotte Waters to Barrow Creek; but he saw no young natives similarly marked. Old blacks of the Arunta tribe, which occupies a large part of the tract of country just mentioned—that is the heart of Australia—had a tradition that a terrible disease traversed their country and destroyed great numbers of their people. When Mr Gillen went to live at Moonta ten or twelve years ago he found that a similar tradition obtained among the Yorke Peninsula (Narrunga or Narrang-ga) tribe, and an old man told him of a place—an old camping-ground—where many of the victims had been buried, but he was never able to find it.

The disease is also recorded from Central Australia by Tietkins (**13**, 112), who mentions that out of fifteen or twenty blacks who visited his camp at the Rawlinson Ranges (24° 30′ southern latitude, 127° 42′ E. longitude) in 1873 eight were unmistakably marked with small-pox.

According to Curr it never made its appearance in Gippsland, nor, according to the same writer, is there any record of it among the natives of the Australian Bight, though he appears to have overlooked a reference to its former presence

at Streaky and Fowler Bays (**13**, 112), where it was believed to have come from the north.

As regards Queensland, the only mention of the occurrence of the disease in this State by an early writer that I have so far discovered is made by Lang (**23**, 340), who speaks of it as a "variolous disease, somewhat similar to the small-pox," and as affecting a tribe of natives on the Upper Brisbane River. He further mentioned that vaccination was a specific.

Later, in 1904, Miss Petrie states (**26**, 65) that when her father first came to North Pine (16 miles from Brisbane) pock-marks "were strong on some of the old men" (this was not long after 1837), who told him that the sickness had come among them long before the advent of the white people, killing off numbers of their comrades. "Pock-marks they called nuram-nuram—the same name as that given to any wart. From this Neurum-Neurum Creek gets its name."

References to outbreaks in other localities might be given, but enough has been said to show that a disease, which is always described either as small-pox or as one very closely resembling it, has been spread so widely, and perhaps more than once, among the Australian natives as to to deserve the term pandemic.

The Question of a Possible Connection between the Sydney Epidemic of 1789 and the Subsequent Outbreaks.

We must now return to the inquiry whether any connection can be traced between the Sydney epidemic in 1789 and that, or those, occurring subsequently in many places.

Dealing first with the manifestations in eastern and south-eastern Australia—where such a connection might most reasonably be expected to be traceable—if such a connection had existed it is remarkable that for more than forty years we find no sign of a recrudescence of any epidemic similar to that in Sydney.

Where was the infection during all these years? Did the next observed outbreaks, of which several seem to have occurred in 1830 or a few years afterwards, originate independently, or did the embers of the Sydney disease remain smouldering, somehow and somewhere, during this long period, to burst into flame again forty years afterwards? These are not easy questions to answer, and either supposition involves difficulties.

If the later outbreaks of 1830-5 were the aftermath of the epidemic of 1789 then we are quite unable to trace the connection between the two. For, apart from the length of the interval, it is difficult to see how, in the case of

natives who wear no clothes and have few personal and permanent belongings, the seeds of the disease could be kept alive for so long, and if it were actually kept alive why did they not germinate in human bodies?

If, on the other hand, the 1830 epidemics arose *de novo* and without any connection with the outbreak that had preceded it forty years earlier, then, for their cause, we are without even the uncertain facts that we possess concerning the possible origin of the Sydney epidemic from the English ships If, however, we could explain the origin of the outbreaks of 1830 it would not be difficult to trace to them those others which, in New South Wales and Victoria, seem to have occurred, between that date and 1845 or thereabouts, at intervals of, at most, a few years, and at places between which the geographical features would have afforded a ready means of transmission.

There is, of course, a third alternative, viz., that these later epidemics of which we are speaking may have been transmitted from the north—a question which will be discussed directly—for it has been mentioned that Wilson(10) found evidence indicative of its presence among the Raffles Bay tribe prior to 1826, and, in face of the difficulties attending other explanations, this is perhaps the most reasonable, as it is the simplest, view to take concerning the manifestations in New South Wales in 1830 and the years following.

As regards the later outbreaks in Western Australia—that is to say, those occurring for the most part between 1865 and 1870—most of them seem to have taken place at points along the north-western coast, and a continuation of this to the north and east brings us, after no very great distance, to that of the Northern Territory, where we have seen that the disease made its appearance about the same period.

It is generally supposed, and indeed it is more than probable, that to the latter coasts the disease was brought by the Malay trepang fishers who have paid annual visits to these localities for many years.

Flinders, whose voyage to the northern coasts of Australia was made in 1803, was at some pains to ascertain the facts concerning the visits of the Malays to these shores. According to the information given him by the captains of a detachment of one of these fishing fleets(11) that he encountered at the English Company's Islands, and subsequently

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(10) *Loc. cit.*

(11) Flinders' statement (**27**, II., 230) that the whole of this fleet comprised sixty prahus and 1,000 men will indicate how numerous were these visitors

by Dutch officers at Koepang, in Timor, these annual visits had begun only about twenty years previously, *i.e.*, about 1783 (**27**, II., 231 and 257). This date is suggestive, for it permits of the possibility that the disease might have existed in Australia even before the 1789 outbreak in Sydney, and it is therefore also quite possible that the latter might have originated in this way, and not from the English ships. We have already alluded to the difficulty, under the latter hypothesis, raised by the long delay of fifteen months before the disease manifested itself. Moreover, the very long interval of forty years which elapsed between the first outbreak and those occurring on the east and south-east in 1830 and subsequently, without any apparent connection, also suggests a fresh introduction, and for this the only source we know of is the northern coast.

And, if contact with the Malays was, as Mr. Foelsche and others believe, the origin of the epidemics occurring in the Northern Territory about 1862-5, it would have been a natural process for the disease to have spread down the Western Australian coast—indeed, as we have said, most of the outbreaks in that State occurred between 1865-70.

To account for its presence in Perth before 1829 (the date of its first settlement) we should have to look to an earlier invasion, which might, however, have had, as we have suggested, a similar northern origin and have been transmitted along a similar route. In this instance, however, we have not, as in the case of the later epidemics of north-western Australia, the history of a whole series of outbreaks the occurrence of which at about the same time, and in localities more or less adjacent both to one another and to the districts visited by the Malays, is strongly suggestive not only of the place of origin of the disease, but of a progressive onward march. Still, even in the absence of similar evidence of continuous progress in the former case, it is easier to suppose that in this, also, it had the same origin and travelled by the same route than to believe that the disease, having originated in the east, passed to the west throughout the whole length of the continent, which hypothesis would, moreover, have involved its transit through very sparsely-populated and desert regions.

It is therefore to be regarded as more probable that the various epidemics of Western Australia resulted from the transmission, down the coast, of the disease originating from the Malays than that it, or they, should have spread from the east across the whole width of Australia.

To account for its presence in Central Australia we must suppose that it reached this region from the east or

from the north, or even from the south, where we have evidence of its presence at an early date. As Mitchell reports it to have been prevalent all along the Darling it might well have reached the centre from this direction, though a northern derivation is, perhaps, equally probable, as there is a succession of contiguous tribes all the way from Port Darwin to the MacDonnell Ranges, and no physical obstacles stand in the way of its transmission [12]

The Nature of the Disease.

So far we have, without argument, assumed that the disease the origin and spread of which we have endeavoured to trace was small-pox, and though the inquiry into its true nature is essentially a medical question, it is necessary to give it some consideration here.

It will have been noticed in what has preceded that the disease was considered to be small-pox by all those witnesses of the first outbreak in Sydney who have mentioned it, though I can find no direct medical pronouncements to that effect, save such as have been stated.

In nearly all of the later epidemics occurring in New South Wales, Victoria, or South Australia it was either definitely called small-pox or spoken of as a disease exactly like it: and the various eruptive and other symptoms that were described, sometimes by medical men, when associated with its severity, contagiousness, and mortality certainly correspond with those of small-pox and to no other known disease.

The outbreak at Bathurst and in its neighbourhood which has been mentioned as occurring in 1830-1 excited so much attention that Dr. Mair, Assistant Surgeon of the 39th Regiment, was sent from Sydney to investigate it. Unfortunately he arrived too late to be an actual witness of the disease in progress, but he made inquiries on the spot and embodied his results in a report to his Government. I have not been able to refer directly to the full text of this report, as no copy of it exists either in the Public or Parliamentary Libraries of this State; but Bennett, when discussing this part of the subject at some length (**15**, I., 148) gives Dr. Mair's own synopsis, which may be advantageously quoted here as summarizing his conclusions: –

(12) Spencer and Gillen have pointed out (**29**, 20) that the line of transmission, as represented by the handing on of corroborees from tribe to tribe and of certain other changes in tribal practices, has always been from north to south and never *vice versa*.

1. The eruptive febrile disease, which lately prevailed among the aborigines, was contagious, or communicable from one person to another, and capable of being propagated by inoculation.

2. It approached more nearly in its symptoms to the character of small-pox than any other disease with which we are acquainted, particularly to that species of small-pox described by Staff-Surgeon Marshall as occurring in the Kandyan Provinces in 1819 (quoted in Good's "Study of Medicine," vol. iii., p. 82).

3. The mortality attending the disease varied from one in three to one in five or six, but might have been less if the persons labouring under it had been sheltered from the weather, and attended by physicians.

4. Vaccination (13) seemed to possess a controlling power over it, as three blacks who had been successfully vaccinated, although equally exposed to the disease, escaped infection.

5. It was not confined to the aborigines, but in one instance attacked a European in the form of secondary small-pox, and proved fatal to a child with symptoms resembling confluent small-pox.

6. In several cases it occasioned bindness, and left many of the poor blacks in a very debilitated and helpless condition, with marks which could not be distinguished from the pits of small-pox on different parts of their bodies.

7. It was never observed to attack any of the aborigines a second time, and it spread alarm and consternation among them.

Bennett (**15**, I., 148), himself a qualified medical man, besides quoting the foregoing summary, comments at some length on Dr. Mair's report, and the perusal of the chapter with the other available evidence will, I think, leave little doubt in the mind of any doctor familiar with the subject that the disease could have been no other than true small-pox. Yet there are circumstances frequently mentioned in connection with the various outbreaks which are not quite consistent with the known behaviour of this disease when epidemic among unvaccinated white people.

1. If Mair's estimate of its mortality during the Bathurst outbreak is correct—for it is not stated how it was arrived at, nor to what number of cases it referred, and, in any case, it could scarcely have been very accurately

(13) The discovery of the protective effect of vaccination was announced by Jenner in 1798.

estimated—it falls below that of English epidemics,[14] whereas one would have expected that the mortality rate of a people affected for the first time by a severe zymotic disease, and in whom there could have been no acquired immunity, would be very high.[15]

2. In Collins' account of the Sydney epidemic it was stated that "its baneful effects were not experienced by any white person of the settlement, though there were several very young children in it at the time." And again in the same work (chap. viii., p. 597) he says "notwithstanding the town of Sydney was at this time filled with children, many of whom visited the natives that were ill of this disorder, not one of them caught it." Curr (**3**) and Bennett (**15**), in their notices of various outbreaks, also frequently allude to the fact that children either did not take the disease or were affected by it less severely than adults. Now, among the European races, young children are more liable to small-pox than older persons, and, moreover, the mortality from small-pox is greatest in the first years of life (see footnote [14]). In fact, in prevaccination days small-pox was regarded as a "disease of childhood, just as whooping-cough and measles were and are." [16]

3. White adults seem to have enjoyed a similar immunity, as will appear from special mention of this circumstance by those writers quoted in the case of the exemption of children, and this notwithstanding the fact that no special precautions seem to have been taken to avoid communciation with the affected blacks.

In spite, however, of these abnormalities in the incidence and effects of the disease we shall, I think, still come

(14) Mair's rates of mortality, reduced to percentages, lie between 33 and 17 per cent. inclusive. In "The System of Medicine," by Allbutt and Rolleston [vol. II., pt. 1 (1906), p. 783], a table of mortality of unvaccinated persons of all ages is given as ranging from 66 per cent. in children up to two years old, down to 23 per cent. for the ages ten to fifteen, and rising again to rates varying from 40 to 50 per cent. for intervening ages.

(15) Catlin (**16**, II., 24), in speaking of the ravages of small-pox among the North American Indians in 1832—about the same date as the Bathurst outbreak, it will be noticed—states that the Pawnees lost 50 per cent., or more, of their number and that many other tribes were also greatly reduced. In the great epidemic of measles, a much less fatal disease among whites than small-pox, in Fiji in 1875 it is estimated that one-third of the native population of the islands perished (**17**, I., 56).

(16) Although the exact proportion cannot yet be given it is evident that the Swanport remains contain a considerable number of young children.

to the same conclusion as that so often expressed by those who were actual witnesses of its symptoms and behaviour, viz., that it was true small-pox. If it was not small-pox, then medical science has no name for it

Advance of the Disease to the Lower Murray

Having so far attempted to discover the origin of the introduction of this epidemic disease, to trace its course throughout the land, and to discuss, very briefly, its nature, it is time to consider the evidence on which it may be considered to have reached Swanport and other localities on the Lower Murray.

Speaking from the standpoint of South Australia there seems to have been a very general belief, which finds frequent expression both in the statements of the blacks and in written accounts, that the disease came from the east and eventually travelled down the Murray.

Published notices directly making, or implying, this statement are to be found in Teichelmann and Schürmann (**12**, 34), Curr (**3**, I., 2, 16), Eyre (**18**, II., 379), and Howitt (**4**, 195), and the separate facts, some of which have been mentioned, confirm the tradition. Many of the places and tribes which are specifically mentioned by Bennett, Curr, Mrs. Langloh Parker (**19**, 39), and other writers as having been subject to outbreaks are situated on, or close to, tributary streams of the River Murray system--some on their upper waters, some lower down.

Thus from Curr we hear of it from an eye-witness of a case near Echuca in 1841 or 1842; at Towanniney (Towanninie), which is near the Murray; and at Swan Hill, on the Murray, at a date estimated to have been about 1807. Its presence at Swan Hill is also alluded to by Mr. Joseph Hawdon in his "MS. Journal" (**20**, 40),[17] a copy of which is in the possession of the Public Library of South Australia.

There is thus ample evidence of the existence of the disease at many places situated on, or near, the banks of the two great tributary rivers that, by their junction at Wentworth, form the main stream of the Murray, and this soon afterwards enters South Australian territory.

From the Darling River and Victorian Murray districts, southwards, I have not been able to trace its successive stages

(17) As this Journal has never been published, and therefore not generally accessible, I will quote the writer's words:—"In the evening some of the blacks came to Swan Hill, where we were encamped. After holding a little conversation with us across the river they swam over to us. They were fine, well-made men, about 5 ft. 11 in. in height; their faces were nearly all marked with small-pox, but otherwise their features were pleasing."

in specified localities until we come to Moorundie.[18] At this place, which is 3 miles below Blanchetown, Eyre was stationed as Resident Magistrate from 1841-4, and he alludes to the existence at some previous period of a disease very similar to small-pox, and leaving similar marks upon the face (**18**, II., 379), though he himself had never seen a case. He states further that it is reported to have come from the eastward.

The Moorundie natives are, as have been mentioned, the northern neighbours of the Narrinyeri, and we can see, therefore, the facilities that would have been afforded for the transmission of the disease along the broad highway of the river, whose banks were frequented by a numerous native population. We know, indeed, that they navigated the river in their mungos, or bark canoes, the last remaining example of which is now in the National Museum.

That it did, however, reach and decimate not only the Narrinyeri, but the adjacent Adelaide tribe, there can be no doubt; to this the written testimony of early writers such as Mr. Taplin, Messrs. Teichelmann and Schürmann, and others, as well as the traditions of the natives and oral statements,[19] bear witness; and although, as we have seen, the actual circumstances of the interments at Swanport do not afford any conclusive evidence that this place, more than any other, had any special association with the incidence of the disease, we shall, I think, in our minds regard its numerous remains as a silent testimony of the event.

When, however, we endeavour to fix a date for this calamity, possibly the one great event of their lives, we are on more uncertain ground. Still, there is a certain amount of evidence bearing on the question which we will examine.

We have some reason to believe (**3**, I., 218) that an outbreak occurred at Swan Hill, on the Murray, about 1807, though it must be admitted that this date, based as it is upon

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[18] G. F. Angas states (**30**, I., 123; and II., 226) that he had himself "seen two aged men from high up the Murray, beyond the great North-West Bend, who were deeply marked with the effects of smallpox." He also states that the natives of South Australia spoke of the disease as having come down the Murray from the country far to the eastward, and almost depopulated the banks of that river for more than 1,000 miles. For these references I am indebted to Mr. T. Gill, I.S.O.

[19] Since the above was written I have a letter (May 17, 1911) from Mr. Paul Martin, now of Appila-Yarrowie, in which he informs me that when, as a boy, he lived at Strathalbyn from 1845-52 and subsequently on the Lower Finniss, he saw numbers of pock-marked blacks, and one of them, an intelligent man then about 30-35 years of age, told him that it came from the east (cf. the statements of Eyre and Angas *ante*).

a mere estimate of an elapsed period of seventy years, rests on a very uncertain foundation. Hawdon [20] reports it from the same place at some period antecedent to 1838, the year in which he visited the locality.

As Swan Hill is the nearest place to the South Australian boundary at which a date can be approximately fixed for the alleged occurrence of an epidemic the event is of some importance to the present part of our inquiry.

If Mr. Taplin's similar estimate of a long period of past years, the actual duration of which, cannot either in his own case or in that of Swan Hill quoted by Mr. Curr, be accurately determined, is to be regarded as approximately correct the date of the Narrinyeri outbreak would be fixed at about 1814 (1, 44).

If, then, we might assume that there is no great error in the estimates on which these two dates, 1807 and 1814, are fixed they might be considered as coming near enough together for us to consider that the Swan Hill outbreak was the forerunner of that occurring among the Narrinyeri.

Moreover, the view that there may have been an epidemic among the natives of the lakes about this time, or. at least, at a period anterior to 1830, receives some support from information recently received from Mr. G. G. Hacket, J.P., of Narrung, Lake Albert, a resident of this district of very long standing. He writes, under dates May 17 and June 1, to the effect that in 1864, when a young lad, he saw pock-marked blacks in these districts. To the best of his recollections these natives were at the time between fifty and sixty years of age, and it would seem, as Mr. Hacket observes, that they must have had the disease in infancy, for they had no recollection of their own particular illness and referred it to a legendary sense.[21] Now, a native fifty years old in 1864 would have been an infant in 1814, which is the date arrived at on Mr. Taplin's estimate, while one sixty years of age would have been only four years of age, or little more than an infant, in 1807, which is the estimated date of the Swan Hill outbreak.

(20) *Loc. cit.*

(21) In the story the blacks told Mr. Hacket the idea that the disease came down the Murray is again prominent, and they also believed that it was brought by an evil spirit. The natives further said that it affected old and young, that the dead were buried where they died, and that in many cases the sick were abandoned and left in their wurleys. Speaking of the skulls used as water vessels Mr. Hacket mentions that he saw them, and that their use was more general about Wellington than round the lakes.

But, according to Messrs. Teichelmann and Schürmann, the date of the disease among the Adelaide tribe was, by a similarly uncertain method of computation, about 1830; or, as these writers put it, "about a decennium" before they wrote, which was in 1840. Now, obviously, a retrospective estimate of ten years based only on the memory of the blacks is less likely to err than one of sixty or seventy years similarly computed, and, if this was the date at which the Adelaide tribe was affected, it is almost certain that this would have been the time at which its neighbours—the Narrinyeri—also suffered. Further, this date of 1830, or thereabouts, is particularly suggestive, for it falls into line with a period at which, as we have seen, several outbreaks are accurately known to have occurred in New South Wales and Victoria.

Moreover, if the statement of the old black, Mrs. Karpeny (on whose very positive and unvarying tale I am disposed to rely), that she was alive at the time when the catastrophe occurred among her people is correct, its date, on that basis, might be fixed some time between 1830 and 1835—that is to say, at the period which would correspond to that of the active manifestation of the disease at Bathurst, New South Wales, and at other places in eastern and south-eastern Australia.

This date would also, to some extent, harmonize with the information given by Mr. Bott's three old black men, for, if they were men of sixty when they told their story in 1881, the personal memory of the oldest of them might well have gone back to 1830, but not to 1807 or even to 1814. If, however, the eldest was seventy he might, as a child of four—which would have been his age in 1807—have retained the memory of a disaster of such magnitude occurring at that date.

On the whole, therefore, and using the admittedly rather uncertain evidence that is available, the most probable view is that the date of the outbreak among the Narrinyeri and Adelaide tribes was during the quinquennium 1830-5. And if Mrs. Karpeny is correct in her assertion that she never saw pock-marked blacks until they had become thus affected, as the result of the epidemic she claims to have witnessed as a young child, then, so far as the Narrinyeri are concerned, there has been only one such epidemic since the beginning of last century, and the earlier date of 1814 computed by Mr Taplin must have been based on an overestimate of years that had elapsed. Whether a similar explanation applies to the supposed outbreak at Swan Hill in 1807, or whether there really was an earlier manifestation of the disease in that locality, it seems impossible to say. There is, however, some

evidence in favour of the view that there was more than one period at which outbreaks occurred in South Australia.

The conclusions stated in the foregoing paragraph have been based upon facts and statements, often of a very indefinite nature, that have been related in the preceding pages; but since they were reached they have, so far at least as they relate to the date at which the epidemic occurred among the Narrinyeri and their neighbours, received additional support of a more precise kind than has generally been found available in this inquiry. In a paragraph in the South Australian *Register* of July 5, 1911, the death is reported, at Poltalloch, of the old black woman who was stated by Mrs. Karpeny to have been her aunt; whether this was the actual relationship according to our nomenclature I cannot say. The old woman, who was known to the whites as Jenny Pongie (native name Clul-lul-owrie), spoke English well and retained her faculties almost to the last. She was, according to her own statements, a grown woman when the epidemic descended on her people, and, according to her account, it came shortly after Captain Sturt's voyage down the Murray. As this explorer reached the lakes on February 9, 1830, old Jenny's evidence fixes the date with considerable definiteness as occurring during the quinquennium mentioned, and probably, it would seem, in the earlier part of this period.

She, too, spoke of a peculiar noise, as of wind, just before the arrival of the disease, which she said came from the east.(22) The writer of the paragraph referred to, Mr. A Redman, superintendent of the Point Macleay Mission Station—as, indeed, does another correspondent, Mr. G. G Hacket—suggests that the noise might have been referable to an earthquake, which is not improbable, for, writes the latter, in the last event of that nature the earth tremors

(22) If, then, we may consider Jenny's age as "a grown woman" to have been sixteen at the date of the occurrence, which, it might be claimed, represents female maturity in her race, this old black would have been ninety-seven years old at the time of her death; and if sixteen is considered to be an unnecessarily early estimate of full growth it would only be required that she should have been three years older for her to have died a centenarian. And, indeed, she was considered by the old residents to have passed the century by three or four years. In any case she affords a remarkable example of longevity in a race that has been assumed without justification, if the evil influences of civilization are excluded, not to be long-lived. Though at the time of my interview with Mrs. Karpeny, recorded on a previous page, I did not attach importance to the accuracy of her estimate of long periods of years I must, with this confirmation and in justification of her statement, now say that on that occasion she told me her aunt must be more than 100 years old.

were accompanied by a rushing wind such as the natives described, and he has heard the natives themselves refer to a similar occurrence.

SUMMARY.

Epitomizing the principal points of the foregoing investigation—

1. There is clear evidence of the occurrence in 1789 of a virulent disease among the aborigines of Port Jackson which was at time considered to be small-pox; and

2. Doubtful evidence that this originated from the English ships that brought the first convicts to Sydney more than a year previously, though there is a possibility that it may have done so.

3. This outbreak having apparently subsided, nothing more is definitely recorded of a similar disease until about 1830 and the years following, when it reappeared at Bathurst, New South Wales, and similar outbreaks seem to have continued at other places in New South Wales and Victoria up to about 1845. There is also some uncertain evidence that the disease may have reappeared still earlier, viz., at Swan Hill about 1807.

4. There is no evidence to show how this later series of epidemics arose, but

5. There is good reason to believe that an outbreak took place in the coastal regions of the Northen Territory between 1862 and 1865, which was presumably brought by the Malay trepang fishers.

6. As the Malays seem to have visited the north coasts of Australia as early as 1783 and to have continued their visits, annually, until the present time they may have been the source both of the Sydney epidemic of 1789 and of those of 1830 and following years in eastern and south-eastern Australia; almost certainly of those occurring in north-western Australia between 1860-70, and possibly of those which, there is some evidence to show, took place still earlier in the nineteenth century both in the eastern and western parts of the continent.

7. However originating, there is abundant testimony to the fact that the disease at some time spread throughout almost the whole of Australia, reaching even the heart of the country.

8. In its symptoms, progress, and behaviour the disease corresponded to genuine small-pox, though in its incidence and effects it differed in some respects from this disease as it occurs among unvaccinated white people.

9. As regard South Australia, there is considerable testimony to support the belief that the disease came from.

the east, probably by river routes, and was transmitted down the Murray, making its effects severely felt among the Narrinyeri and Adelaide tribes, probably between 1830 and 1835—at any rate before the advent of the white settlers in 1836 If, however, Mr. Taplin and some others are correct in their estimates of the length of a long period of elapsed years, without any facts to guide them as to its real duration, there may have been outbreaks both in Victoria and South Australia earlier in the century.

10. To Central Australia the disease may have come from either the north or the east or even from the south—none of these routes would have presented difficulties in transmission; but the invariable migration of certain practices from north to south is suggestive of the first-named direction.

11. In the actual circumstances of the Swanport burials there is no very distinct evidence of the incidence of the disease in such a catastrophic form as to have caused the natives to abandon their ordinary methods of interment for a promiscuous sepulture, though, according to their tradition, the onset was sudden and the mortality great.

Conclusion.

I had hoped in this account to have been able to give some brief survey of the general characters of the Swanport remains. This, however, I am not yet in a position to do, for, apart from the fact that the inquiry pursued in the preceding pages has proved a longer task than I had anticipated, the number of the remains is so considerable, and the bones so mixed, and, in many cases, so broken that the task of sorting and mending is still far from complete, though the whole of our available staff has been engaged in the work ever since the arrival of the remains at the Museum. Besides, their number is still being increased by further additions from the same locality. All I can say now is that the total number of individuals represented by the remains actually received at the Museum, though in many cases only by odd bones or fragments of bones, will probably be found to be about 160. Probably the number actually met with was still greater, for some of the remains have, no doubt, found other destinations. In age they vary from extreme senility, as shown by the edentulous condition of the jaws, to that of children under six months. In some of the remains pathological conditions are present.

At a future date I hope to report further on these remains from a craniological, osteological, and pathological point of view, but as this work will necessitate many hundreds of measurements and calculations of indices it will require some time. It will also be necessary to make pro-

vision for the requisite and now extensive literature bearing on the subject, and for an adequate osteometric outfit.

Finally, I desire to express my thanks to the Commissioner of Crown Lands of South Australia, the Honourable Crawford Vaughan, M.P., who, by his sympathy and prompt action, has made it possible for the National Museum to acquire these interesting relics of a vanishing race. So, also, I must acknowledge the assistance of Mr. T. Duffield, Secretary to the Commissioner; of the Surveyor-General, Mr. E. M. Smith, for allowing his department to supply me with the accompanying map, and for other facilities in the prosecution of this investigation; of the Government photolithographic department for the reproductions which illustrate this paper; and of Mr. Walter Howchin, F.G.S., Chairman of the Museum Committee, who drew for me the sketch of section and has otherwise given his valuable assistance in regard to geological details. Mr. Kellett, Superintendent of the Murray River reclamation works; Mr. A. White, who, as has been stated, first brought the discovery under the notice of the Museum; Mr. E. Baxter, ganger in charge at Swanport; and Messrs. Bott, sen. and jun., have also all given much assistance and, often, personal service in the work of recovery. To Mr. Bott, sen., Mr. G. G. Hacket, and Mr. Paul Martin I am indebted for valuable information that has been recorded in the preceding pages, and to Messrs. J. W. Bakewell and A. C. Minchin for the photographs from which the illustrations have been reproduced. I desire also to acknowledge the zeal and energy with which Mr. Robt. Zietz performed his task as the representative of the Museum. The assistance of all these gentlemen has greatly aided me in my task.

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EXPLANATION OF PLATES.

PLATE II.

View of Swanport, looking south, from the southern end of the swamp, which is seen in the foreground. The cutting from which the bones were obtained is shown in the distance between two eucalyptus trees, and just to the right of Mr. Bott's house. The surface of the sandbank is seen rising to the right. The tramway in the foreground was used for the transportation of the soil to form the embankment.

From a photograph by Mr. J. W. Bakewell.

PLATE III.

The cutting in its condition on April 14, 1911, taken from a point nearer to it than in plate ii.;

From a photograph by Mr. J. W. Bakewell.

PLATE IV.

The exposed face of the cutting from a near point. The band of travertine mentioned in the description is plainly shown crossing the pick-handle standing against it a little below its top end. Patches of broken mussel shells are visible in the kitchen-midden layer. The stones on the top of the bank formed part of the ferryman's house which formerly stood here.

From a photograph by Mr. J. W. Bakewell.

PLATE V.

Another view of the face of the section which shows, towards the right, and just above the pick-handle, the line of demarcation, here distinct, between the kitchen-midden deposit and the subjacent layer of red sand. A skeleton, without the cranium, was removed from the circumscribed excavation of which the travertine forms the floor. The figure is Mr. Bott, sen.

From a photograph by Mr. J. W. Bakewell.

PLATE VI.

Mrs. Karpeny.

From a photograph taken in 1907 by Mr. J. W. Bakewell.

PLATE VII.

Mrs. Karpeny.

It will be noticed by her grey beard that Mrs. Karpeny is a good example of the condition known as hypertrichosis, or excessive hairiness, which is not uncommon among the Australian aborigines; but in her case it is confined to the face. Her beard

would be still longer did she not habitually trim it. Her head is unusually massive, her colour lighter than is usual among her tribe, and her height 5 ft. 2 in.

From a photograph by Mr. A. C. Minchin, 1911.

Plate VIII.

Mrs. Karpeny.

From a photograph by Mr. A. C. Minchin, 1911.

Plate IX.

Map of the Murray, from Murray Bridge to Swanport. The bones were taken from the small Government reserve abutting on the river marked Res.

From a plan supplied by the Surveyor-General.

Description of a Disturbed Area of Cainozoic Rocks in South Australia, with Remarks on its Geological Significance.

By Walter Howchin, F.G.S., Lecturer in Geology and Palæontology in the University of Adelaide.

[Read April 4, 1911.]

Plates X. to XIX.

Contents. Page.

Introduction.

Marine limestones of Lower Cainozoic age occupy nearly the whole of the maritime districts of this State, extending on the westward into Western Australia, and on the eastward into Victoria. The submerged regions at the time when these limestones were laid down included the sites of the three southern capitals of Australia, *viz.*, Perth, Adelaide, and Melbourne. The two important gulfs of South Australia, at that time, were troughs in the open ocean; and Kangaroo Island, Yorke Peninsula, and much of Eyre Peninsula, were sunken reefs in the sea; a wide gulf occupied the Murray Plains, and extended northward into western New South Wales.

Since this period of maximum depression of the southern coastline, there has been an elevation of the land and the sea has retired from its former bed to an extent that has left, at least, 200 ft., in vertical height, dry land. This elevated sea floor has been subjected to various vicissitudes. Active volcanoes have broken through its deposits and spread out sheets of lava and other volcanic material, thousands of square miles in the South-East of this State were again submerged, and the older Cainozoic rocks became covered by newer marine deposits. Exposed to atmospheric waste through long ages these beds have been deeply eroded, lithologically transformed, and, in many instances, reduced to small and isolated fragments.

The age of the beds in question, according to the late Professor Ralph Tate and Mr. J. Dennant, based on the percentage of living species which they contain, is Lower Cainozoic, or the equivalents of the Eocene beds of the

Northern Hemisphore, and these are overlain by a newer marine series, which the gentlemen mentioned referred to the Miocene [1]

Notwithstanding the considerable age of these deposits and the oscillations of level to which they have been subjected, they have, for the most part, preserved an almost horizontal position. The inclination is usually inappreciable, or where it occurs amounts to an angle of less than 5°, giving evidence of a remarkable stability in the earth's crust throughout wide areas in Australia, dating from remote times. There is, however, in this State, one very interesting exception to this rule, which is made the subject of the present paper.

In 1899, Mr. E. V. Clark, B.Sc., a graduate of the Adelaide University, in some "Notes on the Cliffs separating Aldinga and Myponga Bays," published in the Transactions of the Royal Society of South Australia (vol xxiv., p. 1), drew attention to the disturbed area now under description. He says, "Three hundred yards further on Eocene again appears overlying the Cambrian. It is here, however, much inclined, dipping to the north-north-west at an angle of 50° at first, increasing to 65°, and finally diminishing to 45°. It extends seawards for a short distance as a reef, but owing to the high dip it is of no great breadth. Due, however, also to the great inclination, it is extremely regular, and for 150 yards or so where the cliffs take a bend and run approximately parallel to the direction of the strike (west-south-west) it consists of a series of ridges, parallel to each other and to the shore. One ridge in particular, though only 2 ft. wide, is so uniform that it was keeping the sea inside at a height of 15 in. to 18 in. higher than outside. In this the reef is very different from that at the small patch of Eocene rocks to the north, and to the reefs south of the Port Willunga Jetty and at Blanche Point. In these cases, where the dip of the rocks is low, the reef either presents a fairly level surface or, if the rock is not quite uniform, a labyrinthine outcrop, the projecting lines of greatest resistance to wear turning and twisting about extremely irregularly, as is so well seen in the Miocene reef at Schnapper Point, south of Port Willunga Jetty."

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[1] More recent investigations, in which the fauna living in Australian waters have become better known by means of sea-dredging, have reduced the number of supposed extinct species, and it is possible that the question of the age of the Australian marine Cainozoic beds may have to be reconsidered, but for convenience the terms adopted by the late Professor Tate and Mr. Dennant have been used in this paper.

This interesting locality can be most conveniently reached by diverging from the main road at Sellick's Hill township, which is situated one and a half miles from the beach. On two former occasions, one of which was as far back as 1897, I had visited the spot and noted the great throw in the Eocene limestones, but on both occasions circumstances prevented my making a detailed examination of the beds. With the latter object in view I revisited the locality during the late vacation, and took photographs of some of the more interesting features.

At Port Willunga, about 7 miles north of the disturbed area, there are excellent sections of the Cainozoic beds in the sea cliffs, showing a dip of about 5° to the south, by which they are lost to sight at about two miles south of the Port Willunga Jetty. Low banks of alluvium and sand-dunes take their place, and, at about four miles south from the jetty, the old mouth of the Onkaparinga River is indicated by a wide valley with a low shore only feebly protected from the sea.

Immediately south of this point, the sea cliffs, consisting of alluvium, once more make their appearance and increase in height till, at the distance of a mile, they attain a height of 200 ft., with the Cainozoic limestones outcropping at their base. Whether this absence of the limestones from the intervening space of three miles arises from a synclinal fold in the rocks or from erosion effected by the old river drainage, is not quite clear.

Description of the Cainozoic Beds in the Disturbed Area.

(See Map, plate x.)

These beds come to the surface about midway between the outlet of the Sellick's Hill Creek, which has cut a deep canyon in the alluvial beds, and the so-called Mount Terrible Creek,(2) about a mile further south. The beds consist of white and yellowish limestones, of varying hardness, made up mainly of triturated fragments of polyzoa, echinodermata, and shelly material. The outcrop is in two sections, divided

(2) This creek, for the distance of about a mile, forms the boundary between the Hundreds of Willunga and Myponga. It is locally known as the Mount Terrible Creek (or Gorge) under a misunderstanding as to the correct position of Mount Terrible. The latter, as marked on the official maps, is situated one and a half miles to the east of Sellick's Hill township and about three miles from the Creek to which the name of the Mount has become locally attached. A more appropriate name would be Boundary Creek, as it makes the dividing line between the two hundreds mentioned.

by a short space of Cambrian slates which take the place of the Cainozoic limestones in the cliffs and on the beach.

The northern section forms low cliffs up to 15 ft. in height, or, where small washouts have cut back into the alluvial beds that overlie the limestone, the latter is exposed up to 20 ft in height. The rock is easily operated upon by the waves, and as the cliffs come within the range of high tides, the limestone, throughout its entire length, exhibits a series of caves by the undermining of the sea. The beds are not quite horizontal but roll in long, low curves, with an extreme inclination not exceeding 15°, on the one side pitching to the south-east, and on the other, to the north-west.

In addition to its occurrence in the cliffs, the Eocene limestone occurs on the beach, between tides, and, apparently, below low water, in the form of an extended floor or tabular reef. The limestone cliffs disappear shortly before reaching the outlet of Boundary Creek, but the flat reef of the littoral zone continues to the southward until nearly opposite the Waterfall Creek (No. 1), situated at the north side of Section 278 (Hundred of Myponga), and about one-third of a mile south of the Boundary Creek. The position of this creek has been carefully defined for the reason, that, within its channel, not far from its outlet, there occurs a limited outcrop of the Eocene limestone which is of some interest. It is here that the first evidence of an unusual dip in the Cainozoic rocks is markedly evident, as the limestone has a dip north 20° west at 48°. The outcrop is in the form of a bar, which crosses the creek, but is obscured on either side by a cover of alluvial wash of great thickness. Its position, with respect to the Cambrian slates, is peculiar, as it lies almost at the base of a great scarp of these rocks which show a vertical height of 150 ft. facing the sea. The waterfall (No. 1) occupies an acute niche in this scarp-face, and then there is a sheer drop of 20 ft., as the water falls over the edge. The Eocene limestone in this peculiar position is probably a truncated fragment from what was once a considerable sheet of these rocks, resting at a high angle on the down-throw face of the Cambrian beds, as is still the case with the limestones a little further south, but the encroachments of the sea have cut away the upper portions of the fold, leaving a floor of the limestone at sea-level in the fragment referred to.

Immediately to the south of the creek, just described, the Eocene limestones have been completely removed by marine erosion for a distance of about a quarter of a mile, and in this interval the cliffs consist entirely of Cambrian slates, of buff and purple colours. Within this section of the cliffs there occurs another small waterfall (No. 2), fed by

springs, with good water, and maintains a permanent flow. The water is precipitated from a hanging valley, 80 ft. in height, no doubt occasioned by the cutting back of the cliffs by the sea; the first 20 ft. of the fall is vertical and the lower 60 ft. is encumbered by large masses of rock that have accumulated at a sharp angle of its descent.

A little to the south of Waterfall Creek (No. 2), the Eocene limestones reappear, both on the beach and in the cliffs, the coastline at this spot having a more westerly extension, which probably accounts for the reappearance of the beds. These exhibit a high angle of dip, ranging from 40° to 90°, and in one instance, at least, to a distinct overfold. In the sea cliffs, the Eocene beds, to a height of 100 ft., form a thick veneer, resting on the Cambrian rocks, and dip at an angle of 80°. The dip, however, is not in the form of a straight line, but a curve, in which the upper part dips at a lower angle than those portions of the fold that are at sea-level. This gives the beds the appearance of a monoclinal fold, of which only the western limb or septum has been preserved, for the Eocenes run out, easterly, where the ground rises at the back of the cliffs.

The beach at this spot is composed of a number of parallel ridges caused by the truncation of the beds at sea-level. Some of these ridges are very strong and look like masonry. Where the stone has been of superior hardness, sea-stacks, of about 8 ft. in height, have resisted the action of the waves and give evidence as to the dip of the beds a short distance in advance of the cliffs. Some instructive sections are thereby obtained. Several of the stacks show the Eocene limestones in a vertical position, and, in one case, the beds are reversed (plate xviii.). In another stack there are several sharp folds, which, in a zone of about a foot in thickness, exhibit herring-bone structure (plate xvii.). As a rule the beds are not greatly disturbed, other than by the main movement of downthrow, but in a few places, especially near the base of the beds, there are evidences of shatter and some mixing up of the beds.

In one case, seen in the sea cliffs towards the southern end of the section, a very distinct shear plane with overthrust has been developed. The shear plane forms a distinct zone, about 6 in. in thickness, having a dip north 10° west at an angle of 35°. The upper beds in the section have slid over the lower ones, while the differential movement of the mass has led to a discordant dip in the beds above as compared with those below the shear plane, giving an appearance of stratigraphical unconformity (plate xix.). The zone of

thrust consists of ground-up calcareous material in which it is difficult to recognize distinct organic forms

The junction between the Eocene limestones and Cambrian slates is well shown at both the north and south ends of the cliff section At the north end (plate xii.) the base of the Eocene beds is marked by an irregular deposit, about 9 ft. in thickness, of earthy, calcareous, and carbonaceous material, which may represent an ancient soil, or weathered capping, antedating the marine deposits; or, possibly, the crushed-up material produced by a slide of the newer beds over the old Cambrian floor on which they rest. The disturbed area continues for a distance of about three-quarters of a mile, and near its southern extremity a small creek has exposed another cross-section of the unconformity between the Cambrian and Eocene beds. Here the Cainozoic limestones rest directly on the Cambrian slates. The latter are of a bright-pink colour and exhibit parallel jointing to the plane of unconformability which gives the misleading appearance of an identity of dip between the Cambrian and Cainozoic series. This effect is heightened by the bleaching that has taken place along the joints of the Cambrian and thereby brought these divisional planes into prominence The dips of the respective series, are, however, very distinct and discordant, the Cambrian beds dipping north 20° west at 85°, and the overlying Cainozoic limestones north-west at from 30° to 45°. On the south side of this section the newer series forms a capping on the Cambrian slates and rises from sea-level to the top of the cliffs parallel with the coast, where they run out and are not again met with in a southerly direction until Kangaroo Island is reached.

The Cainozoic beds within the disturbed area have suffered a greater or less degree of induration and make a fairly hard and compact stone, but no other evidence of alteration could be detected when examined either macroscopically or microscopically. The general direction of dip varies from west to north-west.

Paleontological Notes.—Reference has already been made to the polyzoanal composition of the limestones. In this respect, as well as in the relative scarcity of molluscan remains and the presence of echinoderms, the beds bear a close resemblance to the upper beds of the same age in the Aldinga cliffs. The large branching polyzoan, *Cellepora*, which is common at Aldinga, is also abundant at Sellick's Hill. The *Turritella aldingæ* beds which are at sea-level at Blanche Point, Aldinga, are not seen in the Sellick's Hill cliffs, although a few isolated examples of this form were noticed in the polyzoanal rock. There can be no doubt that

the beds at Sellick's Hill are on the same horizon as those at Aldinga, the slight palæontological contrasts between the two localities is not exceptional, as the nature of the Cainozoic sediments along the borders of Gulf St Vincent frequently vary within short distances to a very extraordinary degree. The triturated condition and uniform grade of the material which make up these limestones are suggestive of a littoral deposit and the sorting action of the waves. On the southern side of the Sellick's Hill section the limestones become less fragmental and whole forms may be seen, particularly the fronds of *Retepora*, which at some horizons is so abundant that the stone might be classed as a *Retepora* limestone.

Mr. Clark in his paper (*loc. cit.*) has supplied the following list of fossils from these beds, which, he informs me, were identified by the late Professor Ralph Tate:—

CRINOIDEA—*Antedon pertusa*, Tate, M.S.

ECHINOIDEA—*Cidaris*, sp.
Echinus woodsii, Laube.
Lovenia forbesi, Ten.-Woods.
Echinolampas posterocrassus, Gregory
Scutellina patella, Tate
Fibularia gregata, Tate

BRACHIOPODA—*Waldheimia*, sp. (indet)

LAMELLIBRANCHIATA—*Pecten consobrinus*, Tate.

To the above list I may add:—

POLYZOA—*Cellepora*, sp.
Retepora, sp.

LAMELLIBRANCHIATA—*Ostrea hyotidoidea*, Tate.

GASTEROPODA—*Conus*, sp. (Cast.).
Turritella aldingæ, Tate.

TECTONIC CONSIDERATIONS.

The juxtaposition of two series of beds, of distinct ages and stratigraphically uncomformable (as occurs in the district under discussion), is a fortunate circumstance, as it supplies data on which certain great tectonic movements in the building up of South Australia may be recognized.

Many questions are suggested by this unique example of diastrophism in the Cainozoic rocks of our State, as, for example, What was the nature of the earth movements that produced this great distortion of the crust? When did it take place? Was it an isolated movement or an incident connected with a much wider field of disturbance? Has the disturbed area reached the stage of a stable equilibrium, or, are further crustal adjustments likely to occur in the future?

It is certain that the folding of the Cainozoic rocks was caused by earth movements on a large scale in which the Willunga Ranges, as a whole, participated. These ranges form the scarp-face (plate xi.) of an extensive upland plateau that takes in most of the country to the southward. The geological strike runs parallel with this scarp, in a north-east and south-west direction, until it nears the coast, where it turns more to the south and follows the general trend of the coastline. This change in the strike can be seen even at a distance, where the serrated outcrops of Cambrian limestone pass over a round hill, known as Sugarloaf Hill, on the north side of Boundary Creek. At a later stage in our enquiries we shall find that this change of strike is an important consideration in interpreting the geological facts—the strike of the country instead of maintaining a straight course is along two distinct lines, which, in their intersection form an obtuse angle.

Another point, which proves that the Willunga Range movement formed a distinct tectonic unit, can be gathered from the sudden change that takes place in the dip of the Eocene beds as they come into line with these ranges. At Port Willunga, and for some miles to the south, the Eocene limestones have a normal dip, and, even just in front of the great Willunga scarp, they only roll to an extreme inclination of 15°, but immediately they form a junction with the Cambrian of the Willunga Ranges they are thrown into a very high angle of dip, which is suggestive that this high dip has been occasioned by the elevation of the ranges, in which movement the Cainozoic beds participated.

In a study of the Cambrian beds which abut upon the coast we find a confirmation of this view. In the cliffs facing the sea, and for some distance back, the Cambrian slates are greatly disturbed. They are intimately fractured in all directions, rendering it most difficult to determine the true dip. In the Boundary Creek, at about half a mile from its outlet, the beds dip westerly at 48°. A ridge of hard purple slates, between tides, situated near Waterfall Gully (No. 2), shows a dip north-west at 70°. At the point of junction between the Cambrian and Cainozoic beds, each of these appear to have a dip of 80° westerly. This is probably a false dip, so far as the Cambrian beds are concerned, for there was certainly an initial unconformity of strata between the latter and the newer series, and the apparent dip undoubtedly arises from master-joints, slides, and shear-cleavage that have been induced by the earth-strains. These slides are parallel to the coast, they conform to the high dip of the Eocenes, and, as planes of weakness, give rise to frequent

land-slips, exposing smooth faces of rock from which the material has slid. The evidences submitted seem to point to only one conclusion, that in the locality under review there was a common movement of the earth's crust in which both the Cambrian and Cainozoic rocks were equally involved.

We must now attempt to decipher the nature of these earth movements.

It can be safely assumed that a great fault-fissure follows the base of the Willunga scarp, running in a north-easterly direction, and is marked by the valley in which the townships of Bellevue, McLaren Vale, and Kangarilla are situated. Although the exact line of fault is obscured by thick deposits of alluvium, its presence is clearly indicated by the discordance of the strike in contiguous areas and other features. In the Mount Lofty Ranges the general strike is approximately north and south, while the strike in the Willunga Ranges is east 40° north. The existence of such a fault has long been inferred and has now received confirmation by the collateral evidences obtained on the seacoast near Sellick's Hill. The Sellick's Hill coast section does not demonstrate the existence of a north-easterly fault in a direct way, but gives it a high probability, indirectly, in showing that there is a corresponding earth movement facing the sea with which it can be correlated It is an example of block-faulting on a large scale. A segment of the earth's crust has been fractured and tilted. The throw of the rocks has exposed two sides of the fractured block in prominent scarps, which, as already explained, intersect to form an obtuse angle—the Willunga Ranges, forming one limb of the block, and the sea cliffs and Myponga Ranges, the other. The Willunga scarp gives an average height above sea-level of 1,200 ft.

We can take a step further in our investigations, and conclude that the earth movement, so far as the Willunga segment is concerned, was in the direction of an uplift amounting at least to 1,200 ft., bordered on its northern and western sides by downthrows. Looking from Sellick's Hill northwards a great land-slope is seen, rising northerly, until it finds its culmination in the Mount Lofty ridge. On this slope, the highest bed, geologically, occupies the lowest position at the base of the Willunga Ranges; while the lowest bed, geologically, occupies approximately the highest position along the ridge of Mount Lofty. Here we have the rough outline of another great faulted block showing a downthrow to the Willunga scarp.

Another item of evidence in proof of the uplift of the Willunga segment is gathered from the distribution of the Eocene beds within the area. The most distant, as well as the

most elevated, outlier of the Eocene beds in South Australia occurs as a small patch on the Hindmarsh Tiers, near the middle of this elevated plateau (see inset map, plate x.). It is exposed in the head waters of the Hindmarsh River, near Mr. Maslin's, and ten miles distant, in a straight line, south-east from the outcrop on the coast. The beds are under alluvial cover and only seen in creek sections, so that their lateral extent is uncertain. The stone is highly fossiliferous, of a pinkish colour, and consists of a very pure limestone with secondary deposition of calcium carbonate in the interspaces. The old furnace, used for smelting the iron ore from Mount Cone, is in close proximity to the outcrop and the Eocene limestone was used as a flux in the process. The height which these beds occupy above sea-level is probably between 900 ft. and 1,000 ft. The height of Mount Cone, not quite three miles distant, is given, officially, as 1,380 ft. The Eocene beds, in other places, rarely exceed the 200-ft. limit of altitude, so that this outlier on the Hindmarsh plateau is several hundreds of feet higher than any other outcrop of these rocks known in South Australia, and it therefore supplies an indirect proof that the Willunga segment has undergone an uplift relatively to the surrounding areas. This interesting outlier also clearly indicates a former extension of the lower Cainozoic marine series over the area of what, at present, forms the Hindmarsh Tiers plateau, and was, probably, originally conterminous with beds of the same age on the Murray Plains, as well as those on the west in the neighbourhood of the gulfs. Of this great upland sheet of marine limestones this little outlier has alone survived to tell the tale.

Geological Age of the Earth Movements.

The geological age of these earth movements can be defined within certain limits. They were certainly post Eocene, as the beds of this age have been profoundly affected by the tectonic movements. The relationship they bear to the Miocene is not so clear. The Miocene beds usually rest directly on the Eocene—sometimes with a slight stratigraphical unconformity. This is the case at Port Willunga. At Sellick's Hill, however, only the basal beds of the Eocene occur in the cliffs, while the higher strata, at a high dip, pass seawards and disappear below sea-level. If the Miocene beds occupied the same position in relation to the Eocene at Sellick's Hill that they do on the coast further north, they have been placed beyond the range of observation. This is unfortunate, as it leaves the question of the relationship which these great crust movements bore to Miocene times, undefined. It is possible that the movements

took place in the interval between the deposition of the Eocene and that of the Miocene, and if so the Miocene laid down at Sellick's Hill must have shown a much stronger unconformity with the older Cainozoics as compared with the Port Willunga section.

The next newer system represented in the Sellick's Hill section is a thick accumulation of Pliocene (or Pleistocene) clays and gravels, which rest unconformably on the Eocene beds. These alluvial cliffs rise precipitously to a height of 200 ft., and are deeply scored by rain and surface drainage. They are, geologically, undisturbed, and, in places, occupy lines of erosion in the Eocene limestones. We can thus narrow down the limits of the period of tectonic activity as post-Eocene and pre-Pleistocene. This brings it somewhere within the Neogene period, but whether as an inauguration of the Miocene, or as characteristic of some inter-Miocene period, or, as marking its close, or even as Pliocene, we have not at present the data to decide.

The process of disruption probably began in the form of a dome-shaped regional uplift that included most of the southern portion of South Australia. In this upward movement a degree of strain was reached when the rising dome became intersected with fractures, and was split up into vast blocks of country, which, being unequally supported settled along some lines and left others strongly in relief. This process of block-faulting would result in major and minor effects. The great slopes of Mount Lofty to McLaren Vale, and the Willunga scarp and plateau, represent some of the major lines of disruption, and these, again, are split up into secondary blocks, scarps, and trenches which make the minor features of our landscapes. It is very unlikely that these diastrophic effects were produced by a sudden or cataclysmic occurrence, but resulted, no doubt, from a number of small movements, spread over a long period of time, and may even still be in progress.

The downthrow to the gulf, seen in the Sellick's Hill section, supports the view of the existence of a great trough-fault, or graben, in the line of Gulf St. Vincent—a view which has already been assumed by the writer as necessary for the explanation of other local geological phenomena. It is very probable that the earth tremors which occur in the southern portions of the State are connected with these great lines of crust fracture. In the important earthquake of September 19, 1902, the foci of maximum intensity was in Gulf St. Vincent, opposite to the disturbed area described in this paper, and the tremors were particularly severe in a line facing the coast, and also in the valley along the base

of the Willunga scarp, as, for example, at Willunga and Clarendon. It is therefore highly probable that the great 1902 earthquake was caused by a settlement along the north and south trough-fault accompanied by sympathetic movements along the tangential fissures.

With the time data roughly diagnosed, it is instructive to note the amount of denudation that has taken place in the interval. The present coastline along the gulf is exceedingly modern. Since the great earth movements above described the sea has retreated from the gulfs and left them dry and returned again—probably, more than once. At the present time the coast, near Sellick's Hill, is in rapid retreat before the advancing waves. There is a broad plain of marine denudation on the shore which tells of recent loss of land. All the exposed rocks in the cliffs—Cambrian slates, Eocene limestones, and Pliocene clays—are easily operated upon by the waves and as easily removed by the undertow. The encroachments on the land would be still more rapid were it not for the wide floor of truncated limestones, standing up on the beach in successive ridges, which break much of the force of the waves before they reach the base of the cliffs, but it cannot be long before this interesting section will be entirely wiped out.

A better gauge of the time that has elapsed, since the uplift, may be found in a study of the amount of waste that has occurred along the line of scarp. The Willunga Ranges are deeply scored by running water, and, in their varied sculpture, present a picturesque view from the opposite sides of the valley; but all the streams that drain the northern face of the ranges are in a very juvenile stage of development; they are all consequent streams, none are sufficiently advanced to pirate their neighbours, and in no instance has a stream intersected its watershed. The same immature condition of stream development occurs on the plateau and in the glacial districts of Mount Compass and Nangkita, as noted in a paper that I have recently had the honour of reading before this Society.(3)

The measure of denudation accomplished on the Willunga uplift, within a recognized period, may be used as a standard of comparison with other uplifts, in other parts of the State, by which we may infer their synchronism or relative age with respect to the Willunga movements. It is not likely that these movements were strictly local, but rather one phase of a complex and regional disturbance, in which,

(3) Description of a New and Extensive Area of Permo-Carboniferous Glacial Deposits in South Australia. Trans. Roy. Soc., S.A., vol. xxxiv., 1910, p. 234.

possibly, modern South Australia took its main features of relief. It is in this view of the subject that the importance of the Sellick's Hill section must be judged. It forms the geological key for a much wider interpretation, the evidences it supplies is accumulative and consistent, and the conclusions to which it brings us is that within comparatively recent geological times the mountain systems of South Australia have been profoundly affected and have passed through reconstructive stages.

EXPLANATION OF PLATES.

PLATE X.

Map of locality described. Shows the areas occupied by the Cainozoic rocks (which have undergone distortion by earth movements), and also a geological plan of the Cambrian beds that form the Willunga Ranges. Note the juvenile drainage seen on the northern scarp-face of these ranges. The inset-map shows the position of a small high-level outlier of Cainozoic limestones which occurs on the Hindmarsh Tiers.

PLATE XI.

View of Willunga and Sellick's Hill Valley, with the Willunga Ranges and Sellick's Hill in the distance, as seen from Aldinga. The ranges form the north-west fault-scarp of the dislocated block.

PLATE XII.

The basal beds of Cainozoic limestones, tilted, and resting unconformably on Cambrian slates in the sea cliffs.

PLATE XIII.

Folded lower Cainozoic rocks, in sea cliffs, looking north.

PLATE XIV.

General view of Lower Cainozoic rocks, thrown down at high angle, forming sea cliffs, looking south.

PLATE XV.

Nearer view of cliffs shown in plate xiv.

PLATE XVI.

Lower Cainozoic rocks, at high angle, forming spur of cliffs, looking north.

PLATE XVII.

Contorted Lower Cainozoic rocks, forming an isolated pedestal on beach.

PLATE XVIII.

Vertical and reversed folds of Lower Cainozoic rocks on beach.

PLATE XIX.

Thrust-plane developed in Lower Cainozoic rocks, caused by a slide, consequent on trough-faulting. Looking south.

Additions to the Alien Flora of South Australia.

By J. M. Black.

[Read July 13, 1911.]

The following is a list of plants which have been found growing wild, and more or less firmly established in South Australia during the past year, together with notes on a few other species. Those marked with an asterisk are completely extra-Australian in their origin:—

Papaveraceæ.—**Glaucium corniculatum*, Curt. Parnaroo.—A native of the Mediterranean region.

Cruciferæ.—**Sinapis incana*, L. (*Brassica adpressa*, Boiss.) Numerous on roadsides and in fields near Port Lincoln.—Mediterranean region, extending northwards to the Channel Islands. **Alyssum maritimum*, Lamarck. A garden escape (Sweet Alyssum) at Robe.—Mediterranean region.

Caryophyllaceæ.—**Silene conica*, L. (Conical Catchfly.) Common at Robe.—Europe and Western Asia **Spergularia diandra*, Boiss. Oodla Wirra.—Mediterranean region.

Leguminosæ.—**Trifolium suffocatum*, L. (Suffocated Clover.) Keith.—Europe. **Trifolium scabrum*, L. (Rough Clover.) Adelaide Plains and South-East.—Europe. *Kennedya nigricans*, Lindl. Scrub below Mount Lofty (F. S. Salisbury).—Western Australia.

Compositæ.—**Senecio elegans*, L. (Purple Ragwort.) A garden escape growing near the sea at Robe (C. D. Black). —South Africa. **Gazania rigens*, R.Br. A garden escape along the Summit Road, Mount Lofty (F. S. Salisbury).—South Africa.

Boraginaceæ.—**Lithospermum apulum*, Vahl. Marino (H. H. D. Griffith).—Mediterranean region.

Note.—The shrub described as *Lycium chinense*, Mill., in the "Naturalized Flora of South Australia," is really *L. campanulatum*, E. Meyer, a native of South Africa. The true *L. chinense*, which is a more slender and less spiny plant, is also found wild near Adelaide, but is not nearly so common as the other.

Labiatæ.—**Salvia Æthiopis*, L. Ulooloo (North-East); Hundred of Butler (Eyre's Peninsula).—Mediterranean region.

Chenopodiaceæ.—**Chenopodium multifidum*, L. Near Largs (F. S. Salisbury).—South America.

AMARANTACEÆ.—**Amarantus patulus*, Bert. A weed in cultivated land, Blackwood; Mount Gambier.—Mediterranean region.

POLYGONACEÆ.—**Rumex obtusifolius*, L. (Broad-leaved Dock.) East Parklands, Adelaide.—Europe. *Polygonum lanigerum*, R.Br. Reedbeds (H. H. D. Griffith).—Eastern Australia; tropical Asia.

CONIFERÆ.—Note on localities for some species of *Callitris*.—*C. propinqua*, R.Br. Gawler: Franklin Harbour; Mount Brown Forest Reserve (Maiden, *For. Fl., N.S.W.*, xii., 54); Hog Bay, K.I.; Murray Bridge; Port Lincoln (Maiden, *Trans. Roy. Soc.*, xxxii., 255-71); ranges near Adelaide; East Wellington: ranges near Cleve, Eyre's Peninsula (J. W. Mellor); Pinnaroo (J. Sincock). *C. robusta*, R.Br. Mount Brown Forest Reserve and Far North (Maiden, *For. Fl., N.S.W.*, xii., 46); Pinnaroo (J. Sincock); Strathalbyn. I cannot help feeling some doubt as to whether it will be possible to keep *C. robusta* and *C. propinqua* permanently separated as distinct species, at least in this State. *C. cupressiformis*, Vent. Adelaide District; Kangaroo Island (Tate); Hog Bay, K.I. (Maiden, *Trans. Roy. Soc.*, xxxii., 255); Arno Bay (J. W. Mellor), "small tree or almost shrub." *C. cupressiformis*, Vent., var. *mucronata*, Benth. Cape Borda, K.I. (J. W. Mellor): Slape's Gully, Mount Lofty Ranges (H. H. D. Griffith).

GRAMINEÆ.—**Polypogon maritimus*, Willd. Robe.—Mediterranean region. **Bromus rigidus*, Roth. Coast near Adelaide.—Europe.

Note.—Recent investigations, instituted at first by Mr. J. H. Maiden, Government Botanist of New South Wales, go to prove that the introduced Brome, so common throughout temperate Australia, is not *Bromus sterilis*, L., as has been supposed ever since Bentham's identification of it in the *Flora Australiensis*. It now appears that this determination was erroneous and that the grass is really *B. maximus*, L. South Australian specimens of supposed *B. sterilis* were sent to Kew Botanic Gardens and to the Muséum d'histoire naturelle, Paris, with the result that they, like the New South Wales specimens sent by Mr. Maiden to Kew, were pronounced to be *B. maximus*.

Descriptions of Australian Curculionidæ, with Notes on Previously Described Species.

Part IX.

By Arthur M. Lea.

[Read October 3, 1911.]

I have to thank Mr. Gilbert J. Arrow, of the British Museum, for the opportunity to examine some specimens of *Curculionidæ* belonging to that institution; some of these were marked as co-types, and others as compared with types. Comments on a number of these specimens will be found herein, but Dr. E. W. Ferguson is to comment on most of the *Amycterides* sent.

SUBFAMILY BRACHYDERIDES.

Prosayleus sublineatus, n. sp.

Black, antennæ and tarsi (and sometimes the rest of the legs) more or less obscurely diluted with red. Densely clothed with white or greyish scales, interspersed with numerous erect setæ.

Head with small concealed punctures; with a narrow deep partially-concealed median line. Rostrum about as long as the width across eyes, obliquely impressed on each side at base, with a strong partially-concealed median carina. First joint of funicle stouter and slightly longer than second. *Prothorax* in male about as long as wide, in female slightly transverse; sides moderately rounded, base no wider than apex; with numerous partly-concealed granules. *Elytra* elongate-subcordate, at base no wider than prothorax, nowhere parallel-sided, considerably wider in female than in male; with series of rather large but normally almost-concealed punctures; interstices regular, gently convex, very little wider than punctures, but before abrasion apparently much wider. Length, 3-4¾ mm.

Hab.—New South Wales: Illawarra (Geo. Compere), Monaro (Macleay Museum), Queanbeyan, Forest Reefs (A. M. Lea).

A small species that occurs on the flowers of a dandelion-like plant, and that may be taken in abundance by means of the sweep-net. The setæ are longer and more erect than in *Hopei*, but considerably shorter than in *comosus;* in build (except that it is narrower) it more resembles the latter than any other species known to me; but, in addition to the setæ, the scales are different and the size is much smaller.

Both prothorax and elytra, of fresh specimens, usually have a feebly-striped appearance owing to some scales being darker than others. Thus there usually appears to be a feeble dark median stripe, and a feeble one on each side from apex of prothorax to apex of elytra. But on old or dirty specimens the striped appearance is lost. On the under-surface the scales frequently have a greenish or golden-green gloss The setæ are longer on the elytra than elsewhere, and when viewed from in front or behind are seen to form a regular row on each interstice. To the naked eye the apex of the prothorax actually appears to be a trifle wider than the base. The male is smaller than the female, with longer prothorax and legs and narrower elytra, on which the punctures are larger.

PRYPNUS QUINQUENODOSUS, Gyll.

(*P. subtuberculatus*, Gyll.)

In this species the third interstice on e slightly elevated ru the base, and grad teriorly, with the elevated portion suddenly to present a tuberculated appearance I the genus the third interstice, although moi ated, has not this appearance. The suture at ummit of the posterior declivity is marked by conjoined tubercles, but sometimes these are rather feebly defined. The scales in fresh specimens are often more or less golden, but on old and dirty specimens they are usually of a muddy-grey.

The female was described on page 493 of Schonherr's work (vol. i.) under the name of *quinquenodosus*, the male at page 494 as *subtuberculatus*. As the former name appears to be the best for the species I think it should be retained.

PRYPNUS SCUTELLARIS, Fab. (*Prostomus*, Schön.).

In this species the deciduous mandibular processes are unusually stout and firmly attached, and I have never seen a specimen in which they were lost. Near the apex of each there is a slightly oblique outwardly directed ridge in the male. The processes and the somewhat aberrant front tibiæ may have caused Schonherr to regard it as belonging to a different genus to *Prypnus*; but it appears to me to be only a slightly aberrant form of that genus.

Although described from New Holland, it appears to be confined to Tasmania.

Var. MURINUS, n. var.

The typical form of the species is black and highly polished, but there are six specimens before me that differ in

being smaller (15-17 mm. excluding the rostrum), and more or less densely clothed all over with muddy-brown or mouse-coloured scales. In the male the prothorax is more, and in the female less, rugose than in the typical form.

Hab.—Tasmania: Mole Creek (Aug. Simson), New Norfolk, Hobart (A. M. Lea).

SUBFAMILY OTIORHYNCHIDES.

MYLLOCERUS MULTIMACULATUS, n. sp.

Black, parts of legs diluted with red. Densely clothed with greyish scales; with three sooty stripes on the prothorax, and numerous sooty spots on the elytra. Under-... scutellum, and legs with white clothing. Upper-... with short and usually black, or blackish, recurved

... with a rather large but normally-concealed inter-... sides, conjointly with sides of rostrum, regularly ... idth. Rostrum shorter than width of base; ... icircularly encroaching on upper-surface. ... ape stout, strongly curved, shallowly grooved on ... first joint of funicle as long as second and third comb... *Prothorax* feebly transverse, apex almost truncate, base feebly bisinuate, and the width of apex, sides lightly rounded; with numerous small, normally-concealed punctures, and with some larger setiferous ones. *Elytra* oblong-ovate, sides regularly increasing in width to beyond the middle; striate-punctate, punctures rather large, but almost concealed: interstices regularly convex, with numerous small normally-concealed punctures. *Femora* minutely but acutely dentate. Length, 4½-5 mm.

Hab.—Queensland: Cunnamulla (H. Hardcastle).

In size, sculpture, clothing, and general appearance very close to *trilineatus*, but sides of prothorax a trifle more rounded, and elytra with dark setæ not so depressed, the scutellum also is distinctly transverse, instead of slightly longer than wide.

The male differs from the female in being smaller and thinner, with the scape stouter and the legs somewhat longer. The elytral spots are frequently conjoined, and have the appearance of forming feeble zigzag fasciæ.

MYLLOCERUS FOVEIFRONS, n. sp.

Reddish-brown, appendages somewhat paler. Densely clothed with white scales, not quite so snowy on elytra as elsewhere. Setæ of upper-surface depressed, sparse, and indistinct.

Head flattened between eyes; these moderately convex. Rostrum about as long as wide, and distinctly narrower than head, sublateral carinæ fairly distinct before abrasion; scrobes near apex suddenly and strongly encroaching on upper-surface. Antennæ long; scape fairly stout and regularly curved, feebly grooved on lower surface; first joint of funicle feebly curved, slightly longer than second and third combined. *Prothorax* distinctly transverse, apex truncate, base strongly bisinuate and much wider than apex, sides regularly rounded; with sparse, normally-concealed punctures. *Elytra* parallel-sided to beyond the middle; with fairly large, but normally almost concealed, punctures, in regular striæ; interstices gently convex and with small normally-concealed punctures. *Femora* very feebly dentate. Length, 5-6 mm.

Hab.—Queensland: Cunnamulla (H. Hardcastle).

In build approaching *abundans*, but smaller and narrower, prothorax truncate at apex and less transverse; elytra with sparser setæ and rostrum and eyes somewhat different. The clothing is much as in *niveus*, but the wide base of prothorax readily distinguishes it from that species. The curvature of the basal joint of the funicle is a rather unusual feature. From above the scrobes cause the apex of rostrum to appear strongly bifoveate.

On abrasion the prothorax is seen to have sparse and sharply-defined, but rather small, punctures (in which the setæ are set), but under a Coddington lens no smaller ones (for the reception of the scales) are visible.

Myllocerus Hardcastlei, n. sp.

Black, appendages in places more or less obscurely diluted with red. Densely clothed with green scales, varying in places to golden or grey, but nowhere with distinct markings. Upper-surface with distinct, and more or less erect, reddish-brown setæ, longer on elytra than elsewhere; under-surface and legs with shorter, paler, and depressed setæ.

Head flat between eyes; these but little prominent. Rostrum slightly longer than the width of base, sides regularly decreasing in width to apex; middle regularly depressed, with parallel costæ marking margins of depression: scrobes foveiform. Antennæ long and thin; scape lightly curved, apex thickened and on lower surface shallowly grooved; first joint of funicle about as long as second and third combined, second about as long as third and fourth combined. *Prothorax* strongly transverse, apex distinctly incurved to middle, base strongly bisinuate and much wider than apex, sides feebly rounded; setiferous punctures normally concealed. *Elytra* not much wider than base of pro-

thorax, parallel-sided to beyond the middle, with regular rows of rather large, but partially-concealed punctures, in feeble striæ; interstices scarcely separately convex, with minute concealed punctures. *Femora* scarcely visibly dentate. Length, 4½-5 mm.

Hab.—Queensland: Cunnamulla (H. Hardcastle).

The rostrum is strongly at variance with that of others of the genus. The scrobes are very short and subterminal, but immediately behind the insertion of each antenna is a feeble groove bounded inwardly by a carina; the two of these are rather closer throughout their length than usual, and the space between them is gently concave. The eyes are also less prominent than usual. The elytral setæ are decidedly longer than in any other described species in which the base of the prothorax is much wider than the apex, except *mirabilis*; but in that species the rostrum is of very different shape; the eyes very prominent, etc.; *castor*, in which the elytral setæ are fairly long, for the section, has also very prominent eyes, and rostrum of different shape.

The teeth of the femora are normally concealed in fresh specimens. The seven specimens under examination appear to present no distinct sexual features.

TIMARETA PILIPES, Pasc., ♂ (*Dysostines*)
(*D. pustulosus*, Pasc., ♀.)

Two female specimens (one marked as a co-type) were sent to me for examination by the British Museum as *D. pustulosus*. and they agree well with the description. The fine clothing on the prothorax is remarkable, each scale appears to be closely pressed to the derm, and to be in the form of a minute O or U; similar scales clothe the rest of the body and legs, but are mixed to a certain extent with ordinary ones. The pale and dark scales are alike, but the white ones are more conspicuous.

The Museum also sent four male specimens without name labels; they agree with the description of *D. pilipes*, and the remarkable hind tibiæ are as figured by Pascoe for that species, but one specimen is smaller (2 lines, including the rostrum), whilst the others are larger (3-3¼ lines) than the type (2⅓ lines). These specimens I believe to be *pilipes*, and that the form described as *pustulosus* is the female. The finer clothing is exactly as in the co-type of *pustulosus*, and is different from that of any other weevil known to me.

All the Museum specimens are from Albany (King George Sound).

The male differs from the female in being narrower, hind tibiæ very different at apex, front tibiæ inflated towards (but

not to) base; basal segment of abdomen depressed in middle, and second flat, instead of both rather strongly convex.

The species belongs to *Timareta*, as the ocular lobes are entirely absent.

SUBFAMILY LEPTOPSIDES.

Mandalotus dentipes, n. sp.

♂. Black, antennæ and parts of legs more or less reddish. Densely clothed with muddy scales, interspersed with numerous stout whitish or greyish setæ; metasternum with rather long blackish setæ; tibiæ, especially front pair, fimbriated internally.

Rostrum with a narrow more or less concealed carina. *Prothorax* moderately transverse, sides strongly rounded; with transverse granules or interrupted carinæ, traceable through clothing. *Elytra* rather short, closely applied to prothorax, shoulders somewhat projecting, sub-tuberculate behind shoulders; with rows of large but almost-concealed punctures; alternate interstices feebly raised. *Metasternum* and basal segment of abdomen with a wide and rather shallow conjoint excavation. Front *coxæ* obliquely flattened internally, and widely separated, middle each with a strong obtuse tooth on its hind edge; front tibiæ strongly curved towards apex, and distinctly notched at outer apex, hind hair rather strongly curved. Length, 5½ mm.

♀. Differs in being shorter and wider, metasternum and abdomen flat, middle coxæ unarmed, tibiæ shorter and much straighter, and front pair not notched at outer apex.

Hab.—New South Wales: Sydney (E. W. Ferguson).

In my table of the genus [1] would be placed in F; from the four species placed there it may be readily distinguished by the dentition of the middle coxæ and the shape of the front tibiæ.

Mandalotus Taylori, n. sp.

♂. Black, antennæ and parts of legs reddish. Densely clothed with muddy scales, thickly interspersed with stout pale setæ, becoming regular on elytra; tibiæ fimbriated internally.

Rostrum with a narrow distinct carina. *Prothorax* feebly transverse, sides strongly and evenly rounded, median line distinct, with numerous small granules, each with one setiferous puncture. *Elytra* moderately long, conjointly arcuate at base, sides regular, with rows of large, partially-concealed punctures, interstices almost even. Basal segment of *abdomen* with a fairly large excavation at apex, on each

[1] Trans. Roy. Soc., S.A., 1907, p. 131.

side of which is a fairly large obtusely conical tubercle, rather closer to the side than to each other. Front *coxæ* moderately, the middle almost twice as widely, separated; front tibiæ obtusely denticulated on lower surface; hind pair strongly curved, each with an obtuse inner tooth about the middle. Length, 6-7 mm.

♀. Differs in being shorter and wider; abdomen flat and without tubercles; tibiæ less curved and hind pair unarmed.

Hab.—New South Wales: Oberon (Taylor Bros.).

The two abdominal tubercles associate this species with *geminatus* and *amplicollis*. The latter has the tubercles on the second segment, the hind tibiæ very differently clothed and without the small tooth. The former is a much smaller species, with the abdominal tubercles smaller, not at the sides of an excavation, and the front coxæ touching.

The only female I have seen has been returned to Messrs. Taylor Bros.

MANDALOTUS CARINATIPES, n. sp.

♂. Black, antennæ and parts of legs reddish. Densely clothed with muddy scales, thickly but somewhat irregularly interspersed with stout somewhat stramineous setæ; greater portion of under-surface with rather sparse fine setæ or pubescence; tibiæ rather feebly ciliated internally.

Rostrum with carina concealed except near apex. *Prothorax* feebly transverse, almost flat, sides strongly rounded and wider than elytra: with a strong median line and with numerous irregular impressions marking the sides of very obtuse granules or flattened spaces. *Elytra* rather short, conjointly arcuate at base, sides diminishing in width almost from base; with rows of fairly large, partially-concealed punctures, becoming somewhat sinuous on sides; derm somewhat uneven, and with very obtuse tubercles about summit of posterior declivity. *Mesosternum* with a strong, wide, intercoxal projection, truncate at apex and with oblique sides; metasternum and basal segment of abdomen conjointly shallowly concave; apical segment with coarse and dense punctures. Front *coxæ* widely separated; femora stout; front tibiæ obliquely flattened and shining internally on apical two-thirds; hind pair of curious form. Length, 6¼ mm.

♀. Differs in being shorter and wider, prothoracic sculpture more regular, intercoxal process of mesosternum flat and slightly curved, metasternum and abdomen flat, and tibiæ simple.

Hab.—New South Wales: Blue Mountains (H. J. Carter).

In my table of the genus would be placed in A, from all the species of which it may be distinguished by the hind tibiæ of the male. The structure of these represents still another remarkable aberration in this highly interesting genus. Each is somewhat thickened and flattened on the basal half (but not at the extreme base) with the thickened portion shining, and marked by a number of fine transverse carinæ; then on the apical half, on a narrower space, but not on the same plane, there are other short ridges, dividing the side, as it were, into small cells. The front tibiæ are also remarkable. The general outline and the intercoxal process of mesosternum are somewhat similar to those of the male of *niger*, but the sculpture is different.

The prothorax of the male could scarcely be called granulate, but there are numerous shallow impressions that mark some of the boundaries of somewhat granuliform spaces. In the female, however, the granules are more conspicuous, and there are some very distinct punctures.

MANDALOTUS INTEROCULARIS, n. sp.

♂. Black, antennæ and tarsi reddish, tibiæ, coxæ, and under-surface partly or entirely diluted with red. Densely clothed with greyish, more or less variegated scales; and in addition with stout more or less erect setæ, varying from white to black. Under-surface with rather dense but fine setæ or pubescence. Tibiæ with long clothing, especially on the under surface.

Head with a narrow inter-ocular fovea. Rostrum convex and feebly carinated along middle; scape long and thin, rather lightly dilated at apex; first joint of funicle distinctly longer than second, second almost as long as third and fourth combined. *Prothorax* moderately transverse, sides strongly rounded; with close evenly-rounded granules, of rather large size, and readily traceable through clothing; with a narrow median line, continuous to base and almost to apex. *Elytra* at widest no wider than prothorax across middle, shoulders evenly rounded, sides strongly incurved near apex; with regular rows of fairly large punctures; alternate interstices moderately elevated. *Under-surface* with dense fine punctures, with a few of larger size scattered about. Metasternum depressed in middle. Abdomen with basal segment depressed between coxæ, the depression bounded posteriorly by a narrow curved impression, immediately outside of which is a very narrow carina, that is fairly close to the apex, which is strongly incurved to middle. *Legs* rather long; front coxæ widely separated; front tibiæ strongly bisinuate, the apex acutely produced. Length (excluding rostrum), 5½-6½ mm.

♀. Differs in having a shining and conspicuous inter-ocular tubercle; prothorax somewhat smaller; elytra larger, wider, and more ovate; basal segment of abdomen convex and non-carinate; legs somewhat shorter, front tibiæ less curved, more sparsely clothed and the apex less acute; the clothing of the under-surface is also decidedly shorter.

Hab.—Tasmania: Stanley, under stones and abundant in grass-tussocks on summit of the "Nut" (A. M. Lea): Victoria: Forrest (H. W. Davey).

Of the species belonging to the group with carinated abdomen it is distinguished from all, of which the female is known, by the conspicuous inter-ocular tubercle of the female. Of those of which the female is unknown, it is distinguished from *imitator* by the basal segment of abdomen of male less incurved to middle, the carina much less curved, and front tibiæ less hairy and less curved. *Longicollis* has prothorax longer, elytra rougher and differently clothed, front coxæ more widely separated, and basal segment of abdomen less incurved to middle. *Excavatus* and *Severini* have the abdomen very different. It is very close to *arciferus*, and I was at first inclined to regard it as a variety of that species, but the clothing is not so dense, so that the prothoracic granules are more distinct before abrasion, the elytra are not subtuberculate posteriorly, have the alternate interstices elevated, with the punctures, although still of large size, considerably smaller (both before and after abrasion), the rostrum somewhat stouter, and the scape is slightly thicker, except at apex, where it is thinner. The under-surface and legs, usually so distinctive of the species of this genus, are practically identical. There is now no female of *arciferus* before me, but the inter-ocular tubercle of the present species is so distinct, that had it been present on the type female of that species it could hardly have been overlooked.

The clothing is very variable, and is seldom exactly alike on any two specimens. It is usually of a dark ashen-grey, mottled with small darker and paler spots (usually each shoulder has a small pale spot). The suture, especially about summit of posterior declivity, is more or less ochreous. On an occasional specimen there are a few small shining granules on the suture towards the base.

Mandalotus irrasus, n. sp.

♂. Black, antennæ and tarsi reddish, under-surface red or in parts diluted with red. Densely clothed with muddy-brown scales, interspersed with suberect setæ.

Rostrum with a very narrow continuous median carina. Scape somewhat inflated at apex, first joint of funicle about

as long as second and third combined, second as long as third and fourth combined. *Prothorax* lightly transverse, sides evenly rounded, depressed along middle; with rather large but not uniform granules *Elytra* at widest slightly wider than prothorax across middle, base rather strongly trisinuate; with rows of large punctures, interrupted in places by tubercular elevations. *Metasternum* and abdomen flattened, and with fairly numerous small granules. *Legs* moderately long; front coxæ widely separated; front tibiæ bisinuate, the apex acutely produced. Length, 4½-4¾ mm.

Hab.—New South Wales (Macleay Museum).

In my table would be associated with *Coatesi*, from which it differs in being longer and thinner, prothorax and elytra rougher, and front tibiæ sparsely ciliated.

The specimens before me are all more or less dirty, and the scales do not show the least sign of variegation On the under-surface the setæ are much thinner than on the upper-surface, where the clothing is so dense that the granules and punctures are all more or less concealed. The front tibiæ have a few longish hairs, but they are not conspicuously ciliated as in so many species of the genus. The granules on the under-surface are small, but on abrasion are very conspicuous.

A female. in the Macleay Museum, probably belongs to this species, it differs in being larger (5½ mm.), elytra wider, abdomen moderately convex, and front tibiæ less curved.

MANDALOTUS ACUTANGULUS, n. sp.

♂. Black, tarsi red; antennæ feebly or not at all diluted with red. Densely clothed with muddy-brown scales, becoming somewhat variegated on under-surface and legs. With stout recurved setæ.

Rostrum convex but apparently not carinated along middle. Scape not very thin, regularly dilating from near base to apex, first and second joints of funicle narrow at base and wide at apex, first as long as second and third combined, second almost as long as third and fourth combined, third to seventh transverse. *Prothorax* moderately transverse, sides strongly rounded: median line indistinct or absent; with numerous flattened granules, usually wider than long, and arranged transversely. *Elytra* rather strongly emarginate at base, with the shoulders acute and clasping sides of prothorax; with rows of large punctures, regular except on posterior declivity; alternate interstices lightly elevated. Basal segment of *abdomen* lightly concave, its apex rather feebly incurved to middle. *Legs* moderately long; front coxæ moderately separated (slightly less than middle pair); front tibiæ

rather strongly curved and acutely produced at apex. Length, 4-4½ mm.

♀. Differs in having the elytra wider, basal segment of abdomen flat and front tibiæ slightly shorter, less curved and less produced at apex.

Hab.—New South Wales: Blackheath (E. W. Ferguson).

Allied to *setosus* and *dentipes*, from the former distinguished by its smaller size, front tibiæ shorter and different at apex, median coxæ closer together, prothorax with transverse arrangement of granules rather less conspicuous, and scape considerably stouter (although not stout enough to associate it with the *crassicornis* group). From *dentipes* it is readily distinguished by the unarmed middle coxæ and much stouter scape.

Dr. Ferguson sent four specimens (two of which were obtained *in cop)*; on one of them the scales on the upper surface are of an almost sooty black; on another they are feebly variegated on the prothorax.

MANDALOTUS ANGUSTIPICTUS, n. sp.

♂. Reddish-brown or black, some parts reddish. Densely clothed with more or less variegated scales, and with numerous recurved setæ, usually of the same colours as the scales amongst which they are placed. Under-surface with almost silken clothing, especially on the metasternum and two basal segments of abdomen. Front tibiæ with moderately long, but not very dense, ciliation.

Rostrum with a narrow but more or less concealed carina along middle. Scape rather thin, except towards apex; first joint of funicle almost as long as second and third combined, and second as third and fourth combined. *Prothorax* about as long as wide, sides strongly rounded; median line narrow and often indistinct; with closely-packed, small, flattened granules. *Elytra* rather narrow, base feebly trisinuate; with regular rows of rather large but partially-concealed punctures; alternate interstices feebly elevated. *Metasternum* and two basal segments of abdomen conjointly moderately concave. Front *coxæ* moderately separated; front tibiæ bisinuate on lower surface, the apex acutely produced. Length, 4½-5½ mm.

♀. Differs in the elytra being wider; basal segments of abdomen gently convex and with much shorter clothing; legs slightly shorter and front tibiæ less curved and less produced at apex.

Hab.—Tasmania: Stanley, under and at sides of stones, and on summit of "Nut" in tussocks of grass (A. M. Lea).

In some respects close to *piliventris*, but both sexes narrower, male with front tibiæ much less densely ciliated and otherwise different at apex, front coxæ closer together and scape considerably stouter, etc.: *humeralis* is a smaller and rougher species, with base of elytra different; *avenaceus* has very different front tibiæ: and *albonotatus* is wider, with the prothorax larger, and male with very different clothing on both surfaces.

Some specimens have the derm of the entire body black, with the tarsi of a rather bright red, and the funicle and club and base of scape more or less distinctly diluted with red. Others have the derm more or less reddish, sometimes of a rather pale reddish-brown, with all the appendages paler. The clothing is frequently prettily variegated, especially on the males. It is commonly more or less ochreous, with black or sooty or brown markings, on the elytra both colours may consist of more or less numerous spots, or either may prevail in large irregular blotches, but there are usually four pale distinct spots at the base. On old or dirty specimens the clothing becomes more or less of a muddy-grey or brown. The prothoracic granules on many specimens, and especially at the sides, are more or less transversely arranged, but on many others this arrangement is scarcely evident, and it is never very conspicuous.

MANDALOTUS PONDERICORNIS, n. sp.

Black, funicle club and tarsi reddish. Densely clothed with muddy-brown or grey scales; interspersed with numerous stout more or less curved setæ, varying from white to black.

Rostrum convex and with a strong but partially-concealed carina along middle. Scape very stout, except the basal third, which is moderately thin. First joint of funicle slightly longer than second, second about as long as third and fourth combined. *Prothorax* moderately transverse, sides strongly rounded; with numerous small granules, most of which are scarcely traceable through clothing. *Elytra* rather short and subcordate, shoulders strongly rounded, with regular rows of fairly large (but for the genus small) partially-concealed punctures; alternate interstices very feebly elevated. *Metasternum* and abdomen feebly convex. *Legs* rather stout. Length, 3½ mm.

Hab.—Tasmania: Stanley, summit of "Nut" (A. M. Lea).

In my table and the additions thereto this species would come in with *crassicornis*, *herbivorus*, and *ammophilus*, from all of which it differs in being shorter and comparatively wider, with the scape even stouter. It is the first species

with very stout scape to be recorded from Tasmania; the specimen is probably a female, but as the females of the group are but little different to the males I have not hesitated to describe it.

On the under-surface the setæ are all pale and depressed, and they show up more conspicuously than most of those on the upper-surface, although the latter are longer. The first joint of the funicle is rather stout, and from some directions appears to be shorter than the second.

MANDALOTUS SQUAMIBUNDUS, n. sp.

Black or blackish-brown, appendages, and sometimes the under-surface, more or less reddish. Densely clothed with muddy-brown or grey scales. With numerous stout recurved setæ, regularly distributed, and on the elytra forming uniform lines on the interstices.

Rostrum apparently not carinated along middle. Scape moderately long and thin; first joint of funicle slightly longer than second, second distinctly longer than third. *Prothorax* moderately transverse, sides widest slightly in advance of the middle; with dense, concealed punctures. *Elytra* elongate-cordate, base distinctly wider than prothorax, and widest slightly before middle; with regular rows of large, quite-concealed punctures; interstices regular. *Abdomen* gently convex. *Legs* rather short; front coxæ almost touching; front tibiæ acutely produced at apex. Length, 2½-3 mm.

Hab.—Queensland: Port Denison (Macleay Museum).

In my table would come in with *maculatus* and *inusitatus*, but with little resemblance to either, or in fact to any other species known to me. The clothing is somewhat as in *ammophilus*, but that species is considerably larger, with the scape very stout.

The clothing is so dense as to entirely conceal the derm; on abrasion the prothorax is seen to be without granules, but with very dense punctures, and the elytra to have regular rows of large punctures, with uniform and gently convex interstices. The ocular lobes are rather more prominent and lower than usual. There are five specimens before me, three of which have the abdomen slightly flatter than the others, and the elytra somewhat narrower, but the differences are not very pronounced, so that, quite possibly, they are all of one sex.

MANDALOTUS VALGUS, Pasc. (*Dysostines*).

A male co-type of this species (sent by the British Museum for examination) is before me; also another male from the Illawarra district.

The elytra has several feeble inequalities, and in my table (in Trans. Roy. Soc., S.A., 1907, p. 133) the species would be associated with *mirabilis*. It is in fact close to that species, but the middle coxæ are not concave internally, and each has a ridge extending from the middle, where it is subtuberculate, to the hind end; the clothing of the abdomen is also shorter and sparser.

MANDALOTUS FULIGINEUS, Pasc. *(Dysostines)*.
(M. carinativentris, Lea.)

Three specimens of this species were sent by the British Museum for examination, one bearing a name label, and one marked as a co-type. All three are males, and have the abdomen carinated, a character not mentioned by Pascoe, but of primary importance in the genus. The specimens certainly belong to *M. carinativentris*.

Mr. Blackburn thought that *fuligineus* was probably a synonym of *sterilis*, and there is nothing in Pascoe's description to warrant exception being taken to that supposition, but if, as I presume, the two named specimens are correctly identified, then *fuligineus* is certainly not a synonym of *sterilis*, which has the abdomen simple in both sexes.

MANDALOTUS BLACKBURNI, Lea.

A British Museum male of this species is labelled as from Rockhampton (Queensland), but almost certainly in error; a female is labelled as from Tasmania, the type locality.

MANDALOTUS NIGER, Lea.

A British Museum male, labelled as from Queensland, probably belongs to this species, but its mesosternal process is quite rounded, instead of slightly produced. I should have been inclined to treat it as belonging to a distinct species, but as in all other respects it agrees perfectly with seven males of *niger*, it is best perhaps to regard it as an accidental variety.

SUBFAMILY AMYCTERIDES.

TALAURINUS DAMELI, Macl. (1865).
(T. cariosus, Pasc., 1873.)

The British Museum sent for examination four specimens of *Dameli*, one labelled as a co-type of *cariosus*. In the females of this species the shoulders are somewhat projecting (although not as in *Euomus)*. Pascoe described the elytra as "without a trace of setæ." On all the specimens I have

seen, however, black depressed setæ are fairly numerous, but possibly the type was abraded. One of the Museum specimens is labelled "*Westwoodi*, Hope Coll.," but it certainly is not the *Westwoodi* of the Macleay Museum, nor does it agree with Macleay's quoted description of that species.

AMYCTERUS LEICHARDTI, Macl.

A British Museum male, labelled as from South-West Australia, has the elytral tubercles reddish, and this is probably their normal colour, as most of the males that I have seen have similar tubercles.

SUBFAMILY CYLINDRORHINIDES.

PERPERUS LANGUIDUS, Er.

The type of this species is before me. It has the first joint of the funicle longer than the second; a character which will distinguish it from most species of the genus, but in which it agrees with *costirostris* and *malevolens*. From both of these, however, it differs in the antennæ being much thinner, and the median carina of the rostrum obsolete instead of acute and sharply defined. It agrees perfectly, however, with a specimen identified by the Rev. T. Blackburn as *innocuus*, Boh.(2) In general appearance it is very close to *Conloni*.

PERPERUS CERVINUS, Boh. *(Pantopœus)*.

Three specimens before me from Sydney and Maitland (New South Wales) (3) agree with both the generic and specific diagnoses of this species. Three others (from Bulli) have the derm entirely reddish and the pale latero-basal markings of the prothorax less conspicuous.

The second joint of the funicle is about one-fourth longer than the first. The prothorax has a narrowly-impressed median line, which, however, is not always traceable.

The species is quite an ordinary *Perperus*.

PERPERUS DELENS, Blackb. *(Centyres)*.

Mr. Blackburn describes the two basal joints of the funicle as being subequal; this is the case, but the second is slightly longer than the first.

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(2) Neither Erichson nor Boheman described the comparative lengths of the two basal joints of the funicle; a most important feature in *Perperus*.

(3) The only locality given by Boheman was New Holland.

PERPERUS LITORALIS, n. sp.

Black: antennæ, tibiæ, tarsi, and base of femora more or less red. Densely clothed with dark-brown scales more or less feebly variegated on upper-surface: with numerous setæ scattered about. Lower-surface with whitish scales, more or less setose in character.

Head with dense, normally-concealed punctures. Rostrum stout, shorter than front tibiæ; median carina acute and quite distinct through normal clothing. Antennæ rather short and stout; first joint of funicle distinctly longer than second, and second than third, the others feebly transverse. *Prothorax* moderately transverse, sides evenly rounded, apex lightly but distinctly incurved to middle; with very dense and rather small partially-concealed punctures; without granules. *Scutellum* small but distinct. *Elytra* subovate, greatest width about once and one-half that of prothorax; with rows of comparatively small punctures in feeble striæ; interstices feebly convex, not alternately raised. Second segment of *abdomen* slightly shorter than first, but distinctly longer than third and fourth combined. Front tibiæ not denticulate below, but with a few stout setæ or short spines. Length, 5-6½ mm.

Hab.—Tasmania: Ulverstone, Hobart (A. M. Lea).

The female differs from the male in being larger, with elytra wider and punctures smaller and shorter legs.

In general appearance remarkably close to *malevolens*, but front tibiæ with several stout spines, instead of short teeth; the rostrum also is decidedly shorter and stouter. The Hobart specimens were obtained whilst searching for blind beetles at the roots of plants close to a sandy beach. The Ulverstone specimens were probably also taken close to a sea-beach.

The apical segment of abdomen and the apical portion of the elytral margins are sometimes diluted with red. On most specimens before me the clothing of the upper-surface is of a dark chocolate-brown, but on two others it is more or less grey. There is generally a feeble whitish spot close to each eye and another in the middle of the base of each elytron. The sides of the elytra are sometimes feebly spotted and there is generally a whitish stripe on each side of the prothorax, with sometimes a small spot in juxtaposition to the one on each elytron. The elytral setæ are more or less erect and many of them are white, but most of them are similar in colour to the scales. Each femur has generally a whitish ring, with sometimes a rather less distinct additional one.

PERPERUS VERMICULATUS, n. sp.

Black, antennæ almost black. Moderately densely clothed with more or less slaty-grey, feebly-variegated scales. With rather numerous setæ (varying from white to dark-brown) scattered about. Under-surface with whitish scales, thickly interspersed with fine whitish setæ.

Head with dense partially-concealed punctures. Rostrum comparatively thin; median carina traceable through clothing but not very distinct. Antennæ long and thin; second joint of funicle fully once and one-half the length of first, and slightly longer than third and fourth combined. *Prothorax* feebly (especially in male) transverse, sides strongly and evenly rounded, apex scarcely visibly incurved to middle; surface vermiculate; with a moderately distinct median line. *Scutellum* absent. *Elytra* subovate; at base (which is almost truncate) very little wider than base of prothorax; in male not much wider than prothorax at its widest, in female considerably wider; with series of large punctures in feeble striæ; interstices not alternately raised, and not (or scarcely) sinuous about the middle. Second segment of *abdomen* much shorter than first or fifth, and about once and one-half the length of third or fourth. Front *tibiæ* lightly denticulate below. Length, $7\frac{1}{2}$-$9\frac{1}{2}$ mm.

Hab.—New South Wales: National Park (A. M. Lea), Burrawang (T. G. Sloane).

The female differs from the male in being larger, the prothorax less globular, elytra wider, with smaller punctures, the legs shorter and thinner and the antennæ slightly thinner.

The second joint of the funicle much longer than the first will readily distinguish the species from *melancholicus*, which in some respects it resembles. Of those having the second joint longest, it agrees in sculpture most with *cervinus*, but it is considerably larger and the prothorax without the conspicuous latero-basal markings of that species, although there appears to be feeble remnants of such markings.

The hind femora have each a distinct ring of whitish scales, usually with a golden or golden-green gloss, but on the other legs the rings are feeble or absent. Some of the scales on the under-surface (especially of the head) have also a metallic gloss. The prothorax is closely covered with small flattened interlacing ridges, each of which on abrasion is seen to have a row of small but distinct punctures.

Var. Two female specimens (also from the National Park) differ in being more densely clothed, with a large proportion of the scales, even on the upper-surface and rostrum, golden or golden with a rosy gloss. Their derm

also is more or less reddish. In all structural details, however, they agree with normal females.

SUBFAMILY GONIPTERIDES.

OXYOPS MINUSCULA, n. sp.

Castaneous. With dense clothing, varying from white to black, and from stout setæ to scales.

Head with normally quite-concealed punctures; interocular fovea rather large and partially concealed. Rostrum (excluding muzzle) scarcely longer than greatest width; apical portion wide, with small punctures becoming larger posteriorly; basal portion with sculpture entirely concealed, but apparently without a carina. Two basal joints of funicle subequal in length. *Prothorax* evenly convex, with evenly-rounded sides; with dense but more or less concealed punctures; median carina very feeble. *Elytra* elongate-cordate, sides parallel from shoulders to beyond the middle; with rows of large but partially-concealed punctures. Intercoxal process of *mesosternum* strongly produced but obtuse. *Tibiæ* rather short, and strongly, but not clearly, denticulate. Length, 4¾-5 mm.

Hab.—North-West Australia: Murchison (C. French); Victoria: Birchip (J. C. Goudie).

Of very small size, but the mesosternum and eyes are quite as in normal species of *Oxyops*. The three specimens before me vary from rather bright to dark castaneous. The clothing is distinctly variegated, but consists mostly of stout setæ of a pale stramineous. On the prothorax three feeble pale lines can be traced; the scutellar clothing is snowy. On the elytra there is a feeble oblique stripe before the middle, the stripe composed mostly of snowy scales, and remnants of another stripe can be traced beyond the middle; the clothing between being brown or black; but small patches of dark clothing can be seen elsewhere on the elytra. Judging by one of the specimens fresh ones are covered with a brownish meal.

In size, and to a certain extent in appearance, like *simplex*, but the white fascia much less distinct, and of different shape, the eyes less convex but of normal appearance for *Oxyops*, and the mesosternum also normal. It is apparently allied to *arctatus*, but has the elytral clothing variegated.

SUBFAMILY CLEONIDES.

LIXUS IMPONDEROSUS, n. sp.

Black, claws red, funicle obscurely diluted with red. Upper-surface sparsely clothed with short white pubescence

except that in places it is condensed to form spots; under-surface with denser, longer, and more uniform pubescence.

Rostrum almost straight, about as long as front tibiæ, with a faint longitudinal impression between insertion of antennæ; in male with punctures concealed almost to apex, in female only towards base. First joint of funicle slightly longer than second. *Prothorax* lightly transverse, sides evenly rounded, apex about two-thirds the width of base; with dense and fairly large round punctures, the interspaces with numerous small punctures. *Elytra* parallel-sided to beyond the middle, scutellar region flattened; with rows of fairly large, suboblong, deep punctures, becoming smaller posteriorly; interstices with minute and not very dense punctures, becoming rather stronger towards base, third feebly raised at base, and in common with all the base with small granules. *Tibiæ* very feebly denticulate on lower surface. Length, $6\frac{1}{3}$-$6\frac{2}{3}$ mm.

Hab.—New South Wales: Windsor (A. M. Lea).

At first sight the five specimens before me appear to be small ones of *Mastersi*; but the rostrum measured from the lower edge of the eye to its tip is scarcely if at all shorter than the front tibiæ; whilst in *Mastersi* it is very decidedly shorter. Comparing the species together the difference is at once apparent. *Copiosus* has a still stouter rostrum. *Tasmanicus* (a much larger species) has the rostrum longer and the joints of the funicle different. *Albilineatus* is larger, with narrower eyes and very different clothing; whilst *immundus* (or, at any rate, the species I have so named) has the sides of the prothorax impunctate. *Terminalis* is much more narrowed at both ends.

The prothorax is very sparsely clothed, except at the sides, where the pubescence is much as on the under-surface. On the elytra there are numerous feebly-defined spots, giving them a somewhat mottled appearance.

SUBFAMILY HYLOBIIDES.

PÆPALOSOMUS DEALBATUS, Boi.

This species was recorded by Pascoe from many parts of the Malay Archipelago.(4) It was originally described as a species of *Alcides*,(5) and it certainly *looks* like a member of that genus. When living the specimens of it are more or less densely covered with a substance resembling powdered chalk, irregularly distributed over the surface and entirely concealing the derm in places. I have received from the Genoa

(4) Jour. Linn. Soc., xi., 1873, p. 168.
(5) Boi. Voy. Ast., ii., p. 425.

Museum one of the specimens of the species taken by Beccari at Aru, and it agrees exactly with several specimens from North Queensland [6] in my collection.

Both genus [7] and species are now first recorded as Australian.

SUBFAMILY ERIRHINIDES.

Misophrice.

This genus hitherto has been unrecorded from Queensland, a gap I am now happy to fill by the record of three species taken at Dalby on Casuarinas by Mrs. F. H. Hobler. Of these one is represented by two abraded specimens, that appear to belong to *setulosa*, whilst the others are new, and together with two others that have been recently obtained, are described hereunder.

Misophrice Hobleri, n. sp.

Black, scape and basal joint of funicle reddish. Densely clothed with black and green, or golden green, or silvery green scales. Elytra with long suberect blackish hairs, prothorax and head with much shorter hairs or setæ.

Rostrum thin, moderately curved, about as long as prothorax and finely carinated towards base. Scape thin but apex somewhat inflated; first joint of funicle about as long as three following combined. *Prothorax* moderately transverse, sides strongly and evenly rounded; with rather coarse, partially-concealed punctures. *Elytra* at base distinctly wider than prothorax, shoulders square, sides parallel to rear apex; with regular rows of large, suboblong, partially-concealed punctures. *Legs* rather long; front coxæ almost touching. Length, 2-2$\frac{1}{6}$ mm.

Hab.—Queensland: Dalby (Mrs. F. H. Hobler).

A beautiful species with outlines as in many species of *Cydmœa*. The long fine hairs on the elytra are very different to the stout conspicuous setæ of *hispida*.

On the under-surface the scales are rather longer, paler, and more uniform than on the upper, where the paler ones vary from silvery- to golden-green, and occasionally (as also on the legs) are of a fiery-golden colour; they cover a greater space than the black ones; these on the prothorax are almost confined to a fairly wide median space; on each elytron they are in two large blotches (scarcely fasciæ), one at about basal third, the other about apical third, the subapical one being occasionally continued almost to apex, and feebly connected

(6) Mulgrave River, Cairns and Kuranda.

(7) Schoenherr, Mantissa Secunda, 1847, p. 69.

with the sub-basal one along (but not actually on) the suture. The rostrum, except at its extreme base, is glabrous.

MISOPHRICE CRISTATIFRONS, n. sp.

Dull-red, club and most of funicle infuscate. Densely clothed with greyish or dingy-whitish scales, and with two small fascicles or longitudinal crests between eyes. With short recurved setæ.

Rostrum moderately thin, lightly curved, about as long as prothorax, basal half rather strongly carinated. Scape thin and comparatively short, first joint of funicle about as long as three following combined. *Prothorax* moderately transverse, sides feebly rounded and gently diminishing from near base to apex; with dense, almost entirely-concealed punctures. *Elytra* very little wider than prothorax, parallel-sided to near apex; with regular rows of large, partially-concealed punctures. *Legs* stout; front coxæ lightly but distinctly separated. Length, $2\frac{1}{4}$-$2\frac{1}{3}$ mm

Hab.—Queensland: Dalby (Mrs. F. H. Hobler).

Closer to *squamibunda* than to any other species known to me, but larger, front coxæ more noticeably separated, and head conspicuously crested between eyes.

On the upper-surface, both of the body and legs, the scales are entirely without gloss, whilst on the lower surface of the legs they sometimes have a silvery lustre, and on the abdomen they have a beautiful purplish, or golden, or green gloss. The fascicles on the head are probably supported on tubercular swellings. The elytra appear to be conspicuously striated, but this is due more to the partial absence of scales along the lines of punctures than to regular striæ.

MISOPHRICE ORTHORRHINA, n. sp.

Dull-red, parts of under-surface almost black. Densely clothed with somewhat ochreous scales, variegated with brown, and becoming somewhat golden on under-surface and legs.

Head comparatively large. Rostrum straight, rather stout, slightly shorter than prothorax; apical half with small punctures. Antennæ rather stouter than usual; first joint of funicle about as long as three following combined. *Prothorax* rather lightly transverse, sides moderately rounded, base distinctly wider than apex; punctures normally concealed. *Elytra* distinctly wider than prothorax, shoulders rounded, sides parallel to about apical fourth; with regular rows of large, partially-concealed punctures. *Legs* moderately stout; front coxæ lightly separated. Length, 3 mm.

Hab.—New South Wales: Gosford (H. J. Carter).

With the very dense clothing of *squamiventris*, although on a different pattern, but the rostrum straight, and shorter and thicker (unusually so for the genus). *Squamosa*, described as having the rostrum *nearly* straight (it is *quite* straight in the present species), is larger, with clothing very different, colour different, rostrum 5-carinate (this character is probably confined to the male, however), and elytra narrowed from base to apex.

The clothing on the upper-surface is mostly without gloss, but towards the sides is faintly glossed, whilst on the under-surface, head, and basal third of rostrum, it is shining and almost golden. The dark mottlings on the type, and only specimen examined, consist of an irregular median blotch on the prothorax, and several very irregular patches on the elytra, of which the most conspicuous one extends from the basal fifth obliquely to the suture at its middle, but they are probably very variable. Erect or suberect setæ are entirely absent from the upper-surface.

MISOPHRICE CARTERI, n. sp.

Black or blackish - brown, elytra (base, suture, and an elongated spot on fifth interstice posteriorly excepted), legs (tarsi excepted), scape, and basal joint of funicle of a dingy-reddish flavous. Rather sparsely clothed with thin, pale, greenish scales, or setæ.

Rostrum long, thin, and strongly curved, distinctly longer than prothorax, with rows of coarse punctures towards base, but elsewhere almost or quite impunctate. Antennæ thin, first joint of funicle as long as three following combined. *Prothorax* moderately transverse, sides strongly rounded, base distinctly wider than apex; with fairly dense punctures of moderate size. *Elytra* at base slightly wider than widest part of prothorax, sides feebly dilated to beyond the middle, and then evenly rounded with regular rows of fairly large punctures in feeble striæ; interstices with small punctures. *Legs* moderately stout; front coxæ almost touching. Length, 2 mm.

Hab.—New South Wales: Gosford (H. J. Carter).

The black shining rostrum with blackish prothorax will distinguish from *vittata; variabilis* is considerably larger, with shorter and paler rostrum; *apionoides*, *spilota*, *inflata*, *vicina*, and *amplicollis* have paler rostrum and prothorax, and are besides not of the same shape. The outlines of the elytra are as in *spilota*, but the prothorax is much less attenuated in front.

The clothing on the types may possibly be somewhat abraded, but the species belongs to a group on which the

scales are seldom very dense. The abdomen is obscurely diluted with red towards the base.

A specimen from Sydney appears to represent a variety. It has the apex of the prothorax somewhat diluted with red, the elytra with the basal markings continued as to the shoulders, the postmedian longer and feebly connected with the suture; and the clothing rather dense, although still sparse.

THECHIA ALTERNATA, n. sp.

Brownish-red, parts of under-surface darker, antennæ and tarsi paler. Very densely clothed, even on the rostrum almost to its tip, with dingy-greyish, more or less feebly variegated, scales; becoming whitish on under-surface. With fairly numerous, strongly recurved setæ on the upper-surface and legs.

Rostrum moderately stout, lightly curved, about as long as prothorax; with dense punctures entirely covered by scales except at tip. Antennæ rather long and thin, first joint of funicle about as long as second and third combined. *Prothorax* about as long as wide, sides moderately and evenly rounded, base not much wider than apex; with dense, coarse punctures, partially traceable through but entirely covered by clothing. *Elytra* distinctly wider than prothorax, parallel-sided to near apex; with regular rows of large, deep, partially-concealed punctures; alternate interstices moderately raised. *Under-surface* with dense and coarse, but more or less concealed punctures. *Legs* rather stout. Length, 3 mm.

Hab.—Darnley Island (H. Elgner).

The clawless tarsi and seven-jointed funicle are indicative of *Thechia*, from the only previously known species of which (*pygmæa*) it differs in being much larger, elytra densely clothed and with alternate interstices raised; with numerous curious setæ amongst the scales, etc.

The clothing is so dense that the punctures are quite covered, although usually traceable. The setæ are of a most unusual type, being so strongly recurved that the tips are usually concealed amongst the scales, and in consequence they appear decidedly ∩-shaped.

Each elytron at base appears at first to be separately rounded, but at about its middle there is a slight incurvature, so that the space between the shoulders might fairly be regarded as trisinuate.

THECHIA CINERASCENS, n. sp.

Of a dingy-brownish red. Densely clothed with mouse-coloured or muddy-grey scales, becoming somewhat paler

towards sides, and on under-surface and legs; rostrum clothed almost to tip; scutellum, shoulders, and a median prothoracic line, with whitish scales. With a few short, recurved setæ scattered about.

Rostrum moderately stout, rather lightly curved, about as long as prothorax; with dense punctures, more or less concealed except towards apex. Antennæ not very thin, first joint of funicle about as long as second and third combined. *Prothorax* rather lightly transverse, sides strongly and evenly rounded, base not much wider than apex; with dense normally-concealed punctures. *Elytra* distinctly wider than prothorax, shoulders gently rounded, sides parallel to just beyond the middle, and thence coarctate to apex, which is distinctly notched; with regular rows of fairly large, but normally almost concealed punctures. *Under-surface* with dense, but normally-concealed punctures. *Legs* rather stout. Length, 3 mm.

Hab.—Tasmania: New Norfolk, in a grass tussock (A. M. Lea).

Distinguished from *pygmæa* by its larger size, somewhat different shape, and much denser clothing; from the preceding species in being narrower and more fusiform, elytra distinctly notched at apex and with the interstices not alternately raised, the setæ much sparser and less conspicuous, and the antennæ darker.

SUBFAMILY TYCHIIDES.(8)

The *Tychiides* are numerously represented in Australia, although hitherto but few species have been referred to the subfamily. Only four genera and an equal number of species being noted in Masters' Catalogue, and of these two, *Ochrophœbe* (9) and *Orichora* (10) are wrongly placed there.

The species have a strong general resemblance to the *Erirhinides*, practically the only character separating them

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(8) The notes on this subfamily were prepared for inclusion with the species described in these Transactions for 1908, pp 239-251, but were overlooked at the time.

(9) *Ochrophœbe* was compared by Pascoe with *Sibinia* and *Derelomus*, but without being assigned to a definite position; but as its claws were described as simple, it evidently does not belong to the *Tychiides*.

(10) *Orichora* was expressly referred to the *Erirhinides*, and its claws were described as simple. The mistake as to its location in Masters' Catalogue probably arose from the typical species being said to resemble a *Tychius*.

therefrom being the appendiculate claws.[11] The supplementary piece to each claw varies considerably, in some being blunt and basal, in others acute and basal, whilst in others it is so much like the claw itself that each tarsus appears to be terminated by four almost equal claws, and there are numerous intermediate stages. It is often difficult or impossible to see it under a hand lens, and so much manipulation is needed to see it clearly under the microscope, that it is a character that in the present early stage of our knowledge of the subfamily should not be too much relied upon.

The genera known to me from Australia may be tabulated as follows:—

Femora dentate (the dentation, however, sometimes very feeble) ... ... *Elleschodes*
Femora edentate.
  Eyes finely faceted ... ... *Hibberticola*
  Eyes coarsely faceted.
    Tibiæ distorted in male ... .. *Sellechus*
    Tibiæ not distorted in male ... .. *Elleschus*

SUBFAMILY BELIDES.

PACHYURA PYRIATRA, n. sp.

Black; sides of elytra and appendages (two apical joints of tarsi excepted) reddish. Upper-surface rather sparsely and irregularly clothed with whitish pubescence. Under-surface with dense whitish pubescence, denser on sides of sterna than elsewhere, but each abdominal segment with a nude spot on each side.

Head shorter than prothorax; with dense, and in places partially-concealed, punctures. Rostrum stout, wide, the length of head; basal two-fifths with rather coarse, partially-concealed punctures, and a feeble median carina; elsewhere polished and lightly punctate; rather suddenly narrowed beyond antennæ, and then inflated towards apex. Antennæ long and thin, two basal joints moderately stout, first slightly shorter than third. *Prothorax* about as long as wide, disc regularly convex, base strongly bisinuate; punctate-granulate throughout. *Scutellum* strongly transverse. *Elytra* considerably wider than prothorax, shoulders strongly rounded, sides very feebly dilated posteriorly, conjointly rounded at apex, each separately strongly rounded at base; punctate-granulate throughout. *Legs* rather long; femora edentate, posterior passing apex of second abdominal segment; front tibiæ

(11) As the supplementary pieces are often so hard to detect it seems a reasonable supposition that some of our genera have been referred in error to the *Erirhinides*.

feebly, the others very feebly, denticulate below; claw joint of normal length. Length, 6½ mm.

Hab.—New South Wales: Sydney.

The reddish part of the elytra commences on each shoulder, is rather wide to the basal third, then strongly narrowed so as to become purely marginal, but is again dilated and is continuous across apex; the black portion in consequence is somewhat pear-shaped. On the two specimens before me (in each of which the terminal joint of the antennæ is missing) the clothing on the head close to each eye and on each side of the base is fairly dense, on the prothorax it forms a rather feeble median line, and on the elytra it is distributed in feeble spots. The scutellum is densely clothed.

The rostrum, although somewhat like that of *fasciata*, is longer, less polished towards the apex, and not narrowly convex at its middle, the claw joint is longer, and it differs in other details of sculpture and clothing. From *minima* it differs in being longer, but no wider, with longer antennæ and very different clothing on the upper-surface.

Pachyura vestita, Pasc.

Specimens of this species are considerably altered in general appearance by alcohol and abrasion, but the species may be readily identified by the large and granulated tubercles near the base of the elytra; it is the only described Australian species of the subfamily in which such tubercles are present.

SUBFAMILY COSSONIDES.

Xenocnema.[12]

This genus is readily distinguished from all others known to me by the structure of the elytra.[13] Hitherto it has been known only from the typical species, *X. spinipes*[14] of New Zealand. Recently, however, Mr. C. French, jun., has sent me several specimens of a species of the genus, taken in Melbourne in cedar and kauri logs from Queensland. As I was acquainted with the female only of *spinipes*, I sent sexes of the Queensland species to Major Broun, asking for his opinion: this he kindly gave me, together with a male of

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(12) Wollaston, Trans. Ent. Soc., Lond., 1873, p. 499 and p. 587.

(13) These have each interstice between the striæ in two fine parallel costæ. The rostrum of the male is also of enormous width, and is tipped with very strong mandibles.

(14) Wollaston, *loc. cit.*, p. 648; a photo-micrograph given by Major Broun (Trans. N.Z. Inst., vol. xli., plate xvi., fig. 15) will enable the species to be readily identified.

spinipes. He pointed out several slight differences between the two forms, and these, with a few others that are here noted, may be regarded as denoting the Queensland species as worthy of varietal rank.

XENOCNEMA SPINIPES, Woll., var. AUSTRALIÆ, n. var.

♂. Differs from male of *spinipes* in having the rostrum more convex, shinier, with distinctly smaller punctures, and the apical fovea more distinct. The prothoracic punctures are also rather smaller. Length, 3½-5 mm.

♀. Punctures of head, rostrum, and prothorax somewhat smaller.

Hab.—Queensland (C. French, jun.); Kuranda (H. Hacker).

NOTES ON SOME SPECIES OF THE ISOPOD FAMILY SPHÆROMIDÆ FROM SOUTHERN AUSTRALIAN SEAS. PART III.

By W. H. BAKER, F.L.S.

[Read October 12, 1911.]

PLATES XXII. AND XXIII.

The present paper deals with only two species, but these are of more than ordinary interest. The first, though here given as a distinct species, may, however, as a variety be useful in elucidating the very attractive genus *Amphoroidea*. The other, besides belonging to the division *Platybranchiatæ*, presents some unique features of its own.

Family SPHÆROMIDÆ.

Subfamily SPHÆROMINÆ.

Group EUBRANCHIATÆ.

Genus *Amphoroidea*.

Amphoroidea elegans, n. sp. Pl. xxii.

The body is broadly ovate with the epimera spread out laterally. The dorsal surface is very obscurely tuberculate medianly, glabrous, and covered with minute dots. The colour in nature is green, being found among green seaweed.

The head is only a little broader than long, trilobed anteriorly. The eyes are lateral, situated in little angles just anterior to the postero-lateral angles of the head.

The antero-lateral angles of the first thoracic segment reach to the level of the eyes, leaving the anterior portion of the head free. The remaining thoracic segments do not differ much from each other in length.

The anterior portion of the abdomen has a well-marked first segment not showing lateral expansions; the following segment is marked by two sutural lines on each side and has large epimeral expansions a little produced backwards. The posterior portion of the abdomen is domelike, with slightly incurved sides and a shallow lunate posterior notch.

The lamellar expansions of the first antennular joints are rather short and slightly excavate above. There is a very narrow lenticular hiatus between each contiguous margin. The flagellum has 13 joints.

The antennal flagellum has 20 joints, gradually increasing in length, the whole reaching to near the posterior angle of the third thoracic segment.

The epistome is large, with a small median anterior projection.

The mandibles are rather slender with large palps, incisory processes strongly dentate, spine row and secondary plate of left mandible obscure, molar process small, but projecting as far as the incisory process.

Maxillipeds narrow, with lobes of palps small and the fringes of these scanty.

First gnathopods the smallest of the legs, joints very sparingly spined; dactyli small.

Second gnathopods the longest of the legs and not differing much in robustness from those which follow, the second, third, fourth, and fifth joints not differing much in length and covered on their sides, presented inwards with dense, very fine hair; there is also a litle tuft of similar hairs near the distal end of the first joint; dactyli small, each with two very small claws; spines are absent

The third pair of legs are longer than those which follow and little less robust, also strongly ciliated. In the four following pairs the joints are flattened on their surfaces, presented inwards, and are densely furred; the dactyli are short with large curved terminal claws, each showing a somewhat subchelate arrangement with the subterminal claw.

Sternal filaments short, stout, and partially cylindrical.

The uropods are broadly lamellar extending considerably beyond the end of the abdomen, especially the outer rami, the shape of which is irregularly accuminate; the inner rami are truncate.

One male specimen from Victor Harbour.

I have specimens of an *Amphoroidea* from Tasmania which agree well with M. Edwards' figure of *A. typa*, except that the posterior notch is lunate as in the present species. They, however, differ from it in having a narrower body, in having the basal antennular joints larger and more projecting, their combined anterior margins being more arcuate, with the inner margins nearly parallel, in the legs being destitute of fur, in there being a greater distinction in size between the first three pairs of legs and the following ones, and in the uropods being somewhat slenderer. There are four females, none of which show signs of brood.

Group PLATYBRANCHIATÆ.

Genus *Paracassidina*, n. gen.

Paracassidina pectinata, n. sp. Pl. xxiii.

The body is ovate, smooth, moderately convex, with epimera spread outwards, bearing a margin fringe which is short, dense, and with a few longer hairs projecting.

The epistome projects anteriorly as an ovate plate strengthened above by a keel, whose base is in close contact with a short truncate rostral projection, bearing a small swelling on each side.

The head is short, extended laterally to obtuse points; the eyes are prominent and large.

The first thoracic segment is medianly short with its epimeral regions reaching a little anterior to the eyes. The rest of the segments are short and differ little from one another.

The anterior portion of the abdomen shows two segments with an anterior one almost completely covered by the last segment of thorax. The posterior portion is domeshaped, the end being rounded without notch or channel.

The basal antennular joint is trilobed, the anterior lobe is laminate, a little curved outwards, and reaches much beyond the epistomial projection, it has a superior thickening; the median lobe is not laminate, but shorter and narrow, also thickened above, and has near its end on the inner side an opaque swelling like a gland; the lobe is apparently hollow; the posterior lobe is small and laminate. The second joint is slightly expanded, with its antero-distal angle a little produced, the third joint is narrow, the flagellum short with 5 or 6 joints.

The antennal peduncle is of ordinary kind; its flagellum carries 12 joints, which reach as far as the fourth thoracic segment.

The mandibles are small and short with incisory plate, secondary plate, spine row, and molar not much projecting; the palp is long and slender.

The first and second pairs of maxillæ are short and of the usual type.

In the maxillipeds the plate of the second joint is rather short with a distal crowd of short setæ. The palp is large; the third joint is as long as the second, its lobe is proximal, so that a wide gap exists between it and that of the penultimate joint; this joint is short with a long lobe, which is longer and larger than the terminal joint and is situated close to it, so that the setæ of both intermingle.

The first gnathopod is a peculiar prehensile apparatus. The basis, which is nearly as long as the succeeding joints taken together, is slender and a little curved outwards, the merus has its "heel" prolonged, reaching as far as the end of the propodus, where it carries about 10 long, curved, stiff setæ; the propodus also reaches beyond the insertion of the dactylus, this part being thickened and carrying about 6 similar setæ; the dactylus is long and slender.

The second gnathopod is of the usual kind; a rather short curved basis is stout compared with the succeeding joints; the ischium is long and the following joints short and subequal; the dactylus is short and stout with single claw.

The remaining legs are similar, with long ischium joints rendering the succeeding ones very short; the basal joints are robust and little pads are found at their distal ends, as also at the ends of the three following joints; the legs are sparingly hairy with few spines.

In the first pleopods, which are the smallest, the endopod is oblong and about twice as long as broad; the fringes of both rami are very long.

The second pleopods are larger than the first, the fringes are long, and the *appendix* is broad and exceeds the length of the inner ramus.

The third pleopods are fringed, the exopod has a division not very near the end, and there is a slight insinuation on the inner margin.

The fourth pleopod is composed of two ovate thin plates without fringes.

In the fifth pleopods the exopod is nearly twice as long as broad, with three lobes one above the other on the inner margin, as in *Chitonopsis;* there is a faint indication of a division near the end.

The uropods are lamellar, rather narrow, the inner ramus reaches to the end of the abdomen, the outer ramus is a small plate filling a cleft in the side of the uropod.

The female is similar to the male, except that the middle lobe of the first antennular joint is absent and the anterior lobe is smaller; the flagellum has 3 joints; the antenna also is slenderer; the prolongation of the epistome is shorter.

One male and one female without visible brood.

Dredged by Drs. Verco and Torr, Geographe Bay, Western Australia, in 16 to 20 fathoms.

DESCRIPTION OF PLATES.

Plate XXII.

Fig. 1. *Amphoroidea elegans*, n. sp., magnified $2\frac{1}{4}$ diameters.
,, 2. ,, ,, posterior portion of abdomen from the underside.
,, 3. ,, ,, mandible.
,, 4. ,, ,, epistome.
,, 5. ,, ,, maxilliped.

Fig. 6. *Amphoroidea elegans*, first maxilla.
,, 7. ,, ,, second maxilla.
,, 8. ,, ,, first gnathopod.
,, 9. ,, ,, second gnathopod.
,, 10. ,, ,, seventh leg.
,, 11. ,, ,, second pleopod of male.

PLATE XXIII.

Fig. 1. *Paracassidina pectinata*, n. gen. et sp., magnified 6 diameters.
,, 2. ,, ,, anterior region from above.
,, 3. ,, ,, antennule and epistome from below.
,, 4. ,, ,, maxilliped.
,, 5. ,, ,, first gnathopod.
,, 6. ,, ,, second gnathopod.
,, 7. ,, ,, first pleopod.
,, 8. ,, ,, second pleopod, male.
,, 9. ,, ,, fifth pleopod.
,, 10. ,, ,, uropod.

WESTERN AUSTRALIAN POLYPLACOPHORA.

By W. G. Torr, M.A., B.C.L. (Oxon), LL.D.
(Dublin and Adelaide).

[Read October 12, 1911.]

Plates XXIV. and XXV.

In the September, 1910, number of the Proceedings of the Malacological Society of London, vol. ix., part 3, p. 153, Mr. Tom Iredale has some "Notes on Polyplacophora, chiefly Australian." On p. 159, Mr. Iredale says: "I conclude that the chiton fauna of Western Australia will be of a most interesting nature."

Through the courtesy of Dr. J. C. Verco, the President of the Royal Society of South Australia, I was able during the Christmas vacation of 1910-11 to make a fairly thorough exploration of the south coast of Western Australia from Esperance to Albany, and the west coast as far north as Fremantle.

The places visited were Esperance, Hopetoun, Albany, Ellenbrook and Yallingup (south of Cape Naturaliste), Geographe Bay, Rottnest Island, and Fremantle Harbour. With the assistance of Mr. Hedley, conchologist (of the Australian Museum, Sydney), and Mr. Basset Hull, of Sydney, I have been able to identify twenty-three species of Western Australian polyplacophora similar to South Australian species and nine others, seven of which I take to be new.

As Mr. Iredale suggests in the paper mentioned, the list contains representatives of the Adelaidean region. At least fifteen of the identified species are found in his Adelaidean list, one is classified as Solanderian, two are in the Peronian, and three are in the "Doubtful Position" list. The seven new species will probably represent the Autochthonian element to which Mr. Iredale refers.

The small rise and fall of the tides (not more than 2 or 3 ft.) on the visited parts of the Western Australian coast make chiton hunting much more precarious than in South Australian waters. While a large number of South Australian chitons are found in Western Australia, yet there are some striking differences.

I have traced *Plaxiphora albida*, Blain, locally known as *P. petholata*, Sby., all round the South Australian coast from MacDonnell Bay to Murat Bay, a distance of nearly a

thousand miles of coastline, but going out from Murat Bay to St. Francis Island (Nuyts Archipelago), a distance of 40 miles, *Plaxiphora costata*, Blain, formerly known as *P. glauca*, Q. et G., takes the place of *P. albida*, and specimens of *P. costata* were found in Western Australian waters. *P. albida*, Blain., is generally found on or above high-water mark in South Australia, but on the Western Australian coast its place is taken by *Liolophura georgiana*, Q. et G. These could be frequently seen on exposed rocks The order of exposure in South Australian waters, *mutatis mutandis*, is *P. albida*, on exposed rocks at or near high-water mark; *I. crispus*, in abundance everywhere, in sheltered pools, a foot or two below, with *Acanthochites* on sandy moss-covered rocks. In deeper pools, *I. contractus*, *I. cariosus*, *I. ustulatus*, *I. smaragdinus*, and other *Ischnochitonidæ*, and deeper still in 2 or 3 ft. of water at low tide, the true chitons, *jugosus*, *tricostalis*, *exoptandus*, and *calliozona*. On the west side of St. Vincent's Gulf I have found the true chitons on exposed rocks in shallow pools.

The order in which Western Australian chitons are found is *Liolophura georgiana*, near or above high-water mark (*P. albida* and *I. crispus* are missing), and on account of the small fall of the tides *Chitons*, *Callochitons*, and *Ischnochitons* may be found together. The *Ischnochitonidæ* favour shallow pools, while the true chitons prefer the ocean surf.

Chiton torrianus was found in Western Australia on the under-side of wholly exposed rocks. This chiton, formerly misnamed *coxi*, was separated by Hedley and Hull as *C. torri*, afterwards altered to *torrianus*. It was rarely found in South Australian waters till Mr. Walter Klem, of Corney Point, Yorke Peninsula, discovered a number. In Western Australia it was found in almost every place visited.

It is hoped that this first paper on Western Australian Polyplacophora may do something to stimulate and help future beginners at chiton-hunting in Western Australia.

My acknowledgments are due to Mr. W. T. Bednall, whose excellent paper on South Australian Polyplacophora, Proc. Mal. Soc., London, vol. ii., part iv., April, 1897, has been the foundation of much of my work, and to whose paper I have had frequently to refer; also to Mr. M. M. Maughan, B.A., for his kindly revision of my paper and his assistance in examining my new species and verifying some of my descriptions.

1. Callochiton platessa, Gould, 1846.

Chiton platessa, Gould, Proc. Bost. Soc., N.H. II., 1846, p. 143; Pilsbry, Man. Conch., ser. i., vol. xiv., p. 49.

Three specimens collected. It is common in New South Wales, rare in the Adelaidean and Western Australian regions. Specimens obtained at Rabbit Island (Albany), Ellenbrook, and Rottnest Island. Colour markings resemble New South Wales species. Dark-red with splashes of orange and olive-green. About 20 valves of a bright-pink colour, picked up at Ellenbrook, were evidently bleached specimens of *platessa*.

2. ISCHNOCHITON (STENOCHITON) JULOIDES, Ad. and Ang., 1864.

Stenochiton juloides, Ad. and Ang., Proc. Zool. Soc., 1864, p. 193; Pilsbry, Man. Conch., ser. i., vol. xiv., p. 55.

Two anterior valves and one median valve of this very slippery chiton were collected in shell-sand at Albany.

3. ISCHNOCHITON CARIOSUS, Carpenter, 1873.

Heterozona cariosa, Carpenter, MS.; Pilsbry, Man. Conch., ser. i., vol. xiv., p. 65.

Numbers of these were found at Rottnest Island, Albany, Hopetoun, Yallingup, and Ellenbrook (south of Cape Naturaliste). The Western Australian specimens are much less coated with serpularia, etc., than the South Australian species.

4. ISCHNOCHITON USTULATUS, Reeve, 1847.

Chiton ustulatus, Reeve, Conch. Icon., sp. 102; Pilsbry, Man. Conch., ser. i., vol. xiv., p. 96.

Several specimens were taken on the west coast at Rottnest Island and Yallingup. None were found on the south coast. This chiton travels easily. One collector reports finding them in abundance at one spot in South Australia, but they had all vanished a few days later.

5. ISCHNOCHITON CRISPUS, Reeve, 1847.

Chiton crispus, Reeve, Conch. Icon., sp. 120; Pilsbry, Man. Conch., ser. i., vol. xiv., p. 89.

Ischnochiton Haddoni, Pilsbry, Man. Conch., ser. i., vol. xiv., p. 88.

The specimens classified as *I. crispus* are either so small or in such bad condition that I have hesitated in allowing *crispus* to appear at all. They were found only in the places examined nearest to the South Australian border, Esperance and Hopetoun. It is interesting to find that a chiton so common in South Australia and Victoria should be so rare in Western Australia. The specimens found closely resemble our South Australian *I. variegatus*, which is probably only a variety of *I. crispus*.

6. ISCHNOCHITON CONTRACTUS, Reeve.

Chiton contractus, Reeve, Conch. Icon., sp. 78; Pilsbry, Man. Conch., ser. i., vol. xiv., p. 93.

Chiton pallidus, Reeve, Conch. Icon., sp. 92; Pilsbry, Man. Conch., ser. i., vol. xiv., p. 89.

Fairly common in sheltered pools on the south coast. I have specimens from Hopetoun and Albany.

7. ISCHNOCHITON DECUSSATUS, Reeve, 1847.

Chiton decussatus. Reeve, Conch. Icon , sp. 107; Pilsbry, Man. Conch., ser. i., vol. xiv., p. 93.

Chiton castus, Reeve, Conch. Icon., sp. 145.

Lepidopleurus speciosus, H. Adams and Angas, Proc. Zool. Soc., 1864, p. 192.

Two specimens were taken from buoys between Fremantle and Rottnest Island. Through the courtesy of the harbour-master we were permitted to be present at the lifting and cleaning of the buoys. *I. decussatus* is frequently found attached to such shells as *Pinna inermis*, Tate

8. ISCHNOCHITON PTYCHIUS, Pilsbry.

Ischnochiton ptychius, Pilsbry, Nautilus, vol. viii., p. 53.

Ischnochiton ptychius, Bednall, Proc. Mal. Soc , vol. ii., part 4, April, 1897.

One specimen of this rare chiton was taken from the anchor of a buoy between Fremantle and Rottnest Island.

9. ISCHNOCHITON VIRGATUS, Reeve.

Chiton virgatus, Reeve, Conch. Icon., sp. 192; Pilsbry, Man. Conch., ser. i., vol. xiv., p. 78.

Several specimens were found at the Quarantine Station, Albany. Some of my specimens are of a creamy-white, which may possibly need to be placed under a new species.

10. ISCHNOCHITON THOMASI, Bednall, 1896.

Ischnochiton Thomasi, Bednall, Proc. Mal. Soc., London, vol. ii., part 4, April, 1897.

One diminutive specimen was dredged from 20 fathoms in Geographe Bay.

11. ISCHNOCHITON RESPLENDENS, Bednall and Matthews, 1906.

Ischnochiton resplendens. Bednall and Matthews, Proc. Mal. Soc., London, vol. vii., part 2, June, 1906.

Several specimens of this beautiful chiton were taken at Yallingup, and an anterior valve at Ellenbrook, both south of Cape Naturaliste, and also at Albany. No specimen of its close ally *I. smaragdinus* was seen.

12. Callistochiton antiquus, Reeve

Chiton antiquus, Reeve, Conch. Icon., sp. 169; Pilsbry, Man. Conch., ser. i., vol. xiv., p. 274.

Specimens were obtained at Albany, Ellenbrook, and Yallingup.

13. Chiton tricostalis, Pilsbry, 1894.

Chiton (canaliculatus, var. ?) tricostalis, Pilsbry, Nautilus, vol. viii. (1894), p. 54.

Two specimens from Ellenbrook, south of Cape Naturaliste, one dark olive-green mottled with creamy-white, terra-cotta, and light-green, the other terra-cotta with splashes of red and white.

14. Chiton torrianus, Hedley and Hull, 1909.

Chiton torri, Hedley and Hull, Records of the Australian Museum, Sydney, vol. vii., No. 4, 1909, p. 162.

Chiton Hullianus, Iredale, Proc. Mal. Soc., London, vol ix., part 2, June, 1910, p. 103.

Chiton torrianus, Mal. Soc. Journal, March, 1911, vol. ix., pt. iv.

Numerous specimens of this handsome chiton were taken at Esperance, Albany, Yallingup, Ellenbrook, and Rottnest Island. Valves were plentiful on the beaches. I have them up to 50 mm. in length. It is evidently one of the common chitons of Western Australia.

15. Chiton bednalli, Pilsbry, 1895.

Chiton Bednalli, Pilsbry, Nautilus, vol. ix., p. 90, December, 1895.

One median valve of this, the most beautiful of all our chitons, was dredged from 20 fathoms in Geographe Bay. Most of the specimens taken in South Australia have been dredged.

16. Chiton exoptandus, Bednall, 1897.

Chiton exoptandus, Bednall, Proc. Mal. Soc., London, vol. ii., part 4, April, 1897.

One anterior valve and one median valve were taken from 20 fathoms in Geographe Bay.

17. Lorica volvox, Reeve, 1847.

Chiton volvox, Reeve, Conch. Icon., sp. 31; Pilsbry, Man. Conch., ser. i., vol. xiv., p. 237.

Chiton cimolius, Reeve, Conch. Icon., sp. 141.

Valves of this very large species were picked up at Rottnest Island and Ellenbrook, south of Cape Naturaliste.

18. PLAXIPHORA COSTATA, Blain.

Chiton costatus. Blain, Dict. Sc. Nat., xxxvi., p. 548; Pilsbry, Man. Conch., vol. xv., p. 105.

Plaxiphora glauca, Quoy and Gaim.; Bednall, Proc. Mal Soc., London, vol. ii., part 4, April, 1897.

Chiton glaucus, Quoy and Gaim., Voy. Astrolabe, Zool. iii., p. 376.

Plaxiphora glauca, Pilsbry, Man. Conch., ser. i, vol. xiv., p 325.

Plaxiphora costata, Iredale, Proc. Mal. Soc, London, vol. ix., part 2, June, 1910, p. 97.

Mr. Iredale says: "Blainville's *costatus* is easily recognizable as the species I have noted as *glauca*, Q. et G." He agrees with Dr. Thiele in his "Revision des Systems der Chitonen" in placing *P. petholata*, Sow., as *albida* of Blainville and *P. glauca*, Q. et G., as *costatus*, Blain.

Good specimens of *P. costata* were found at Rottnest Island, Albany, and Bunbury, and valves were plentiful at Ellenbrook and Yallingup.

I notice that Blainville took *P. costata*, or, as he named it, *Chiton costatus*, from the "Port of King George" Western Australia, therefore, is the first locality where the shell was found. Quoy and Gaimard found it in d'Entrecasteaux Channel, Tasmania

19. ACANTHOCHITES ASBESTOIDES, Smith, 1884.

Chiton (Acanthochiton) asbestoides (Carpenter, MS.), Smith, Zool Coll., H.M.S. "Alert," p. 833; Pilsbry, Man. Conch., ser i., vol. xv., p. 17.

Acanthochites asbestoides, Carpenter; Pilsbry, Proc. Acad. Nat. Sec., Philad., 1894.

Two specimens taken at Albany.

20. ACANTHOCHITES SPECIOSUS, H. Adams, 1861.

Cryptoplax (noloplax) speciosus, H. Adams, Proc. Zool. Soc., 1861, p. 385.

Acanthochites speciosus, H. Adams, Pilsbry, Man. Conch., ser. i., vol. xv, p. 32.

One specimen of this rare shell was found at Rabbit Island, near Albany.

21. ACANTHOCHITES VERCONIS, Torr and Ashby, 1898.

Acanthochites Verconis, Torr and Ashby, Trans. Roy. Soc., A., 1898, p. 217.

One specimen dredged from 20 fathoms at Geographe Bay. Mr. Hedley, conchologist, of Sydney, is unable to separate *A. Verconis* from *A. Wilsoni*, of Sykes, Proc. Mal. Soc., London, vol. ii., part 2, July, 1896.

22. Cryptoplax striatus, Lamarck, 1819.

Chitonellus striatus, Lam., An. S., Vert. vi., p. 317, 1819.

Cryptoplax striatus, Pilsbry, Man. Conch., ser. i., vol. xv., p. 53.

This chiton was taken at Hopetoun, on the south coast, and at Yallingup, on the west coast. Valves were obtained at Hopetoun, Ellenbrook, and dredged from 20 fathoms in Geographe Bay. I concur with Messrs. Gatliffe and Bastow, of Melbourne, in placing the hairy, seal-like specimens with *striatus* and the hairless one with *var. Gunnii*, of Reeve.

23. Cryptoplax striatus, *var.* gunnii, Reeve.

Chitonellus gunnii, Reeve, Conch. Icon., sp. 5.

Cryptoplex striatus, var. *Gunnii*. Pilsbry, Man. Conch., ser. i., vol. xv., p. 54.

Two specimens of this hairless species were found at Yallingup. They are both destitute of the "minute calcareous spinelets" of *striatus*. The valves are narrower, and in both specimens of a deep-pink colour. When examined with *striatus* they seem worthy of being placed in a distinct species.

Note.—The foregoing 23 species are all found in South Australian waters.

24. Liolophura georgianus, Quoy and Gaimard, 1835.

Chiton Georgianus, Quoy and Gaim., Voy. "Astrolabe," Zool., 1835, iii., p. 379, t. 75, f. 25-30.

Liolophura Georgiana, Quoy and Gaim.; Pilsbry, Man Conch., ser. i., vol. xiv., p. 241.

Chiton Georgianus, Iredale, Proc. Mal. Soc., London, vol. ix., part 3, September, 1910.

The type specimen was found by Quoy and Gaimard at King George Sound, South-west Australia (Port du Roi-Georges). Mr. Iredale says that the type appears to have been lost. It is the commonest chiton in Western Australian waters. The specimens I have dissected correspond to Quoy and Gaimard's description. It certainly is not a true chiton, and I have not been able to discover the presence of eyes necessary to place it among *Liolophura;* but this may be accounted for by the fact that it is exceedingly difficult to get a clean specimen. They are either very much eroded or covered with calcareous matter and other foreign growths.

I have been assisted in my nomenclature by Messrs. Hedley and Hull, of Sydney.

L. georgiana was seen in every place visited, Esperance, Albany, Ellenbrook, Yallingup, and Rottnest Island. Some years ago one specimen with the girdle removed was sent to

me from Eyre Patch, Western Australia, not far from the South Australian boundary. It is often found high and dry in crevices of rocks at and above high-water mark. It is remarkable that no specimens have been discovered in South Australian waters when it is so common in Western Australia. It occupies a similar position in Western Australia to that taken by *Plaxiphora albida* in South Australia.

The figure in Pilsbry, vol. xiv., plate 53, figs. 36-40, shows the concentric marking and the beaks of the valves very distinctly. My specimens are nearly all much worn, and only a few valves retain the beak; the more perfect specimens show both the beak and rows of concentric polished pustules on the anterior valve, radiating from the apex.

25. ONITHOCHITON QUERCINUS, Gould, 1846.

Chiton quercinus, Gould, Proc. Bost. Soc. Nat. Hist., 1846, voi ii., p. 142; U.S. Expl. Exped. Moll., p. 312, figs. 437, 437a; Otia, Conch., p. 3.

C. (Onithochiton) quercinus, Gould, Otia, Conch, p. 242.

C. Incii, Reeve, Conch. Icon., 1847, No. 94.

Onithochiton rugulosus, Angas, P.Z.S., 1867, pp. 115, 223.

O. Incii, Angas, P.Z.S., 1867, p. 223.

O. Lyelli (non Sow.), Pilsbry, Man. Conch., vol. xiv., p. 247.

O. quercinus, Gould; Pilsbry, Man. Conch., vol. xiv., p. 248.

O. rugulosus, Angas; Pilsbry, Man. Conch., vol. xiv., p. 249; Proc. Acad. Nat. Soc., Phil., 1894, p. 88.

O. Incii, Reeve, Thiele, Zoologica Chim., Heft. lvi., p. 99.

O. quercinus, Gould; Iredale, Proc. Mal. Soc., London. vol. ix., part 2, June, 1910.

Specimens of this very beautiful chiton were taken at Esperance. Albany, Ellenbrook, and Rottnest Island. On the outlying reefs at Rottnest they could be seen crawling over the reefs very energetically. Gould's type specimen was a small one—length, 22 mm.; breadth, 15 mm. I have a dried specimen, slightly curled, taken at Port Esperance—length, 52 mm.; breadth, 23 mm. It is beautifully coloured. Those found on exposed rocks were covered with foreign matter. I have to thank Messrs. Hedley and Hull for the identification of this species.

Unfortunately I have not had access to a description of *Onithochiton Scholvieni*, Thiele, Zool. Chun. 1909. Heft. lvi., p. 99. Mr. Iredale says in the paper quoted that the specimens in the British Museum are labelled "West Australia." He thinks that is correct. My specimens of *O. quercinus* vary considerably. It is possible that I may be able to place some of them with *Scholvieni*.

26. ISCHNOCHITON VERCONIS, *sp. nov.*

Plate xxiv., figs. *1a,b,c,d,e,f*.

Mr. Hedley says: "This is certainly a new species and a magnificent one. One would need to disarticulate a valve to be sure of the classification. Probably it is an *Ischnochiton*, and perhaps of the section *Ischnoradsia*." As only one specimen was found I am not disarticulating, but hope to supplement my description later.

General Appearance. Shell elliptical, flattened, side slopes curved. Colour, uniformly slatish-grey, tending to heliotrope. Girdle and valves of the same colour.

Anterior Valve. No very distinct markings. Surface rough with irregular concentric growth lines and minute longitudinal striæ. Eight teeth.

Posterior Valve. Mucro-median, prominent; divided into two distinct areas by a slightly-raised riblet running up to the mucro. The anterior half has longitudinal colour markings with microscopic nodulose lines. To the unaided eye it seems smooth. The posterior half has concentric irregular nodulose lines similar to the anterior valve.

Median Valve. The pleural and dorsal areas run together, while the lateral area is very distinct. The dorsal area is smooth, horny, with brown-pencilled longitudinal lines and microscopic zigzag striations. The pleural area has very delicate longitudinal markings. The lateral area is distinctly raised and has a lighter shade of colour than the pleural. The very slight longitudinal and lateral markings give it a textile appearance.

Girdle. Clothed with imbricating scales, curved, apices suberect; under the microscope the scales are beautifully frosted over and show about ten transverse parallel grooves. The girdle is one-third of the depth of the lateral area, about 3 mm. across.

Interior. Bluish-grey colour with broad sinus and dark splashes near the sinus of each valve. The anterior valve has delicate brown pencillings from the sinus to half its depth with eight riblets.

Measurement. Dried specimen. Length, 44 mm.; breadth, 28 mm.

Habitat. Rockpool, inside reef, Ellenbrook, south of Cape Naturaliste, Western Australia.

Remarks. It is different in shape from any Australian Ischnochitons, and the only specimens in my collection of similar shape are *Mopolia lynosa*, Gould, from California, and *Chiton Magnificus*, Deshayes, from the Philippines. This species has been named after Dr. Verco, to whose generosity

I have been indebted for the opportunity of exploring Western Australian *Polyplacophora.*

27. PLAXIPHORA HEDLEYI, *sp. nov.*

Plate xxiv., figs. *2a,b,c,d,e,f*

General Appearance. Shell ovate, narrowing toward the anterior, side slopes curved Colour pale-green with five black and white zebra stripes in the pleural area The articulamentum is a milky-white with dark splashes at the sutures.

Anterior Valve. Radially ribbed with eight rounded costæ dying off toward the apex. These correspond with the eight slit rays in the interior of this valve.

Posterior Valve Insertion plate smooth, unslit, like all plaxiphora Sinus broad and rounded Insertion plates large. Colour, milky-white, splashed with brown and black stripes.

Median Valve. Dorsal area beaked, forming an equilateral triangle, with a central ridge almost smooth and splashed longitudinally on its posterior margin, with black-and-white stripes varying in different valves. In one valve microscopic striæ run out diagonally from the central area. To the unaided eye the dorsal area is pale-green, smooth, and horny The division between the dorsal and pleural areas is distinctly marked by five white and five black zebra bands, small toward the apex and lengthening toward the girdle. The pleural and lateral areas seem to run into one another, a slightly raised radial rib marking the division. The pleural and lateral areas have a mottled appearance, with splashes of brown and white or black and white. The internal part is a milky-white with a distinctly-raised rib, broad at the apex and narrowing off to one tiny slit. The sinus is broad and the sutural plates neatly curved.

Girdle. Leathery with microscopic granulations. Narrow with sutural horny protuberances, some spikes remaining. Colour alternately black and white, black at the valves and white at the sutures, 11 or 12 stripes of each colour on each side.

Measurement. Dried specimen Length, 16 mm.; breadth, 11 mm.

Habitat. Rabbit Island, Albany. Two live specimens and one median valve.

Remarks. This specimen has been named after Mr. Hedley, conchologist, whose wide conchological information has helped many a beginner. The zebra-like stripes will cause this specimen to be easily distinguished.

28. Acanthochites subviridis, *sp. nov.*

Plate xxv., figs. *3a,b,c,d,e,f.*

General Appearance. Shell elongated, narrow, carinated, side slopes curved. Colour creamy-white with a pale-green tint on some of the valves, a brighter green on the dorsal area with a pink-tipped beak in some specimens; girdle dark-buff.

Anterior Valve. Strongly marked with fine granulose, radiating costæ corresponding to the five slit rays. The sutural plates are much larger than the tegmentum. Internally milky-white with a curved sutural band.

Posterior Valve. Distinctly marked with dorsal and latero-pleural areas. The dorsal area is a smooth ridge, irregularly transversely striated, terminating in fine radial riblets, which are continued in the sutural plates as slit rays. The latero-pleural area is covered with squamose granules. Sutural plates large, sinus wide.

Median Valve. Dorsal and latero-pleural areas same as posterior valve with the exception of two postmedian granulose radial riblets, one on the anterior margin. In some specimens these riblets are strongly pustulose, small at the apex, and increasing in size toward the margin. Internally one slit ray, sutural plates large, sinus medium. The dorsal area is a pale-green colour, with in some cases a pink tip. In others it is a dark-buff.

Girdle. Leathery, very broad, 7 sutural tufts on each side, and 4 round the anterior valve. Elementary spicules may be seen in one or two. Colour dark-buff, resembling the girdle of *Cryptoplax Gunnii.*

Measurement. Length, 22 mm.; breadth, 12 mm.

Habitat. Four specimens from Rabbit Island, Albany.

Remarks. I was very much inclined to place this specimen under *A. costatus*, Ad. and Ang., Pilsbry, Man. Conch., ser. i., vol. xiv., p. 40, but the *distinctly pustulose riblets* and coloured dorsal areas with other minor differences have led me to place it under a new species. Adams and Angas' drawing of *A. costatus* gives a very diminutive riblet. The minute fringe of white spicules, described by E. A. Smith, Zool. Coll. "Alert," p. 83, t. 6, f. F., as *Chiton (Macandrellus) costatus*, is absent in all the specimens. The greenish tint so common has given its name, *subviridis*.

29. Tonicia hullianus, *sp. nov.*

Plate xxv., figs. *4a,b,c,d,e,f.*

General Appearance. Shell elliptical, broad, smooth, back rounded, side slopes curved, valves distinctly beaked.

Colour reddish-buff, mottled on dorsal areas, turning to deep-red on some of the lateral areas, a few minute irregular black and white spots. Second valve larger than any of the following five. The forward part of the lateral areas and the posterior and anterior valves bear radiating rows of eye-dots.

Anterior Valve. About 15 or more fine striæ radiating from the apex with a slightly raised rib between each pair. These rays are really the eye-dot lines. I counted 15 eyes in one ray. There seems to be on either side a sort of flesh-coloured lateral area. The rest of this valve is a pale-pink, mottled with cream. Dentition: Eight slits are distinctly visible, but as I have only one specimen I have not dissected it. The insertion teeth are pectinated.

Posterior Valve Large, mucro median *rectangularly elevated*. The dorsal area is smooth, beaked with irregular lateral striæ. The eye-dots radiate from the mucro to the insertion plate. Colour dorsal and posterior area pink, mottled with cream, and on each side corresponding to the lateral area which is of a rich red colour The insertion plates are pectinated with probably a dozen slits.

Median Valves. Dorsal area is V-shaped, curved, and beaked, colour pinky-buff, mottled with cream. Pleural area small, flesh- or buff-coloured, depressed with concentric growth lines running from lateral into pleural and dorsal areas. Lateral areas, some flesh-coloured, others mottled as in the dorsal areas, five or six irregular flattened ribs. Eye-dots irregular on the anterior half of each valve. Insertion plates, one slit, pectinated. The sutural plates are diminutive, sinus shallow and pectinated, and the interior is porcelain-white.

Girdle. Leathery, nude. Breadth in dry state, 2 mm. Colour light-brown.

Measurement. Dried specimen. Length, 30 mm., breadth, 20 mm. Divergence, 125°.

Habitat. Rockpool, Ellenbrook, south of Cape Naturaliste. One live specimen and one median valve.

Remarks. The Genus *Tonicia* is somewhat rare in Australian waters. I have named this very handsome species after Mr. A. F. Basset Hull, whom Mr. Iredale describes as "the most enthusiastic chiton student in Australasia."

30. LEPIDOPLEURUS NIGER, *sp. nov.*

Plate xxv., figs. *5a,b,c,d,e,f.*

General Appearance. Shell small, broad in proportion to length. Valves rounded and raised. Regular granulose striations are microscopically conspicuous. Colour dark

slatish-grey on anterior and 5 median valves, posterior valve almost black.

Anterior Valve. Longitudinally parallel rows of pustules.

Posterior Valve. Almost black; umbo postmedian, with concentric pustulose striæ.

Median Valves. Regularly longitudinally granulosely striated. No difference in the dorsal, lateral, and pleural areas.

Girdle. Diminutive, dark, scaly, and with spicules.

Habitat. Under stones in shallow pools at Hopetoun, Western Australia. Only one specimen was found.

Measurement. Dried specimen. Length, 4 mm.; breadth, 2½ mm.

Remarks. I had classified this as *L. Matthewsianus*, Bednall, which is so common in South Australian waters, but on comparing them I found it much broader in proportion to its length, and the body of the animal which is uniformly red in *L. Matthewsianus* is almost black in *L. Niger.* I then placed it with *L. Badius*, Hedley and Hull, and found it very similar, with the exception that the grain rows were distinctly regular. Its dark appearance has given its name.

31. Plaxiphora zebra, *sp. nov.*

Plate xxv., fig. 6.

A beautiful median valve was collected at Port Esperance and is worthy of a name. The valve is rounded. The *dorsal area* is indistinct with 10 irregular creamy tear-drop pustules in the centre forming a V with diagonal striations terminating in the anterior part of the valve. The lateral part of the dorsal area has three or four transverse striæ continued into the pleural area. The colour is a delicate pink, mottled with white and brown splashes. The *pleural area* has a number of zigzag pustulose riblets running into the striations coming from the dorsal area and narrowing toward the apex. Colour: Five alternate splashes of bright-red and creamy-white give the shell its name. The lateral area is distinctly raised with two rows of 9 or 10 large pustules on its anterior and posterior margins with a sulcus between, irregularly pustolose and striated. The pustules have the tear-drop appearance of those in the dorsal area. Interior is porcelainous, sinus curved, broad, shallow, and pectinated. The sutural plates are small, one slit. The anterior part of the valve is folded over and an irregular sulcus is formed, terminating in the slit. The specimen may have been bleached, so that the pink splashes in the pleural area may have been brown or black.

The markings are very like *P. Hedleyi*, but the lateral area makes a distinct species.

Habitat. Port Esperance. One median valve.

32. PLAXIPHORA PUSTULOSA, *sp. nov.*

Plate xxv., fig, 7.

One median valve was taken at Albany and is in perfect condition. The valve is slightly arched and beaked. The posterior part of the dorsal area has 12 bright-brown transverse riblets divided by pale-green striæ, rather crowded toward the posterior. These riblets are continued into the pleural area in rows of bright shiny pustules, longitudinally parallel, and diminishing in number from seven near the dorsal area to one at the insertion plate. The lateral area is slightly raised, but very distinct. It has three or four radiating rays of the tear-drop pustules

Interior. The sinus is gracefully curved, colour rich dark-brown, slightly pectinated. The sutural plates are small. The rear part is folded over, making a white limy sulcus, ending in one slit at the insertion plate

Habitat. Albany, Western Australia. One median valve.

Brighton,
South Australia.

EXPLANATION OF PLATES.

PLATE XXIV.

1a,b,c,d,e,f—*Ischnochiton verconis*, sp. nov.
2a,b,c,d,e,f—*Plaxiphora hedleyi* sp. nov.

PLATE XXV.

3a,b,c,d,e,f—*Acanthochites subviridis*, n. sp.
4a,b,c,d,e,f—*Tonicia hullianus*, sp. nov.
5a,b,c,d,e,f—*Lepidopleurus niger*, sp. nov.
6—*Plaxiphora zebra* (median valve), sp. nov.
7—*Plaxiphora pustulosa* (median valve), sp. nov.

a—Dorsal view of entire shell.
b—Anterior valve.
c—Median valve.
d—Posterior valve.
e—Lateral view of posterior valve
f—Portion of girdle magnified.

Sizes of type specimens are marked in each case

NOTE DESCRIPTIVE OF A STEREOGRAM OF THE MOUNT LOFTY RANGES, SOUTH AUSTRALIA.

By W. N. BENSON, B.Sc.

[Read August 10, 1911.]

PLATES XX. AND XXI.

In a previous paper a short outline was given of the physiography of the Mount Lofty Ranges as it appeared to the writer from observations made during 1908.(1)

Recently a stereogram has been constructed for the Sydney University to illustrate the features on which his conclusions were based. A brief description of this model may not be out of place here. The information on which it was modelled was obtained from the official map of south-eastern South Australia and the topographic map of the vicinity of Adelaide. Trigonometrically-determined heights are sadly few in number. The general relief of the area between Noarlunga, Angaston, and Murray Bridge, and in the Inman Valley is based on the writer's own sketches and aneroid readings. A topographic map of Mount Barker district published in the daily Press during the military manœuvres of 1908 was also of service. The modelling of the area about Mount Compass is based on Mr. Howchin's map and descriptions (2) and additional information kindly supplied by him.

Owing to the writer's non-acquaintance with areas outside these limits the model may be subject to some modification in those parts, and indeed owing to the smallness of scale no more than a very rough accuracy has been attempted throughout.

The small inset model illustrates the main tectonic features. As these are being investigated in detail by Mr. Howchin a very brief description will here suffice.

The main portion of the Mount Lofty Ranges, stretching from beyond Angaston to Cape Jervis and extending into Kangaroo Island, is a peneplain. The main drainage, before uplift, was in mature valleys running in an approximately meridional direction.(3) On the peneplain surface were residuals of a higher level, monadnocks, such as Mounts

(1) Trans. Roy. Soc., S.A., 1909, p. 107.

(2) Trans. Roy. Soc., S.A., 1910, pp. 231-47 and pls. xxxi. to xlv.

(3) W. Howchin, Geography of South Australia, p. 124.

Lofty and Barker, composed of a resistant rock, usually quartzite. In comparatively recent, probably at the close of Pliocene, times this peneplain was elevated, by upthrust chiefly, rather than by folding.(4)

Stratigraphical proof of this uplift is afforded by the presence of raised marine Eocene fossils (5) on the hills behind Encounter Bay, at the head of the Hindmarsh River,(6) where they occur at an altitude of 1,000 ft.

Mr. Howchin has also noted the presence of steeply dipping and overfolded Tertiary beds near Sellick's Hill.(7) By this movement the drainage was much altered. Erosion readily removed the soft glacial clays and sandstones from the Inman, Hindmarsh, and Upper Finniss Valleys, and in the first named exposed in places the hard glaciated Permo-Carboniferous land-surface.(8)

The uplift was not *en bloc*, but the area was broken up into larger and small blocks which were differentially elevated, tilted to some extent, and possibly slightly flexed. This makes fault scarps a frequent feature.(9) The small inset model shows the series of fault-blocks that form the western flanks of the range. They are roughly triangular in shape and are tilted sloping to the south. They may be due to differential elevation in the first instance or may have dropped off the main peneplain, collapsing after their original uplift.

A somewhat similar series of steps, though less well marked, appears on the eastern flanks of the Range, as at Palmer and the Bremer Range. It is possible that Mount Lofty and perhaps the Forest Range are on a block raised above the general level, of which German Town Hill would be the eastern scarp. This feature is not shown on the model, however, chiefly because it has not been sufficiently studied by the writer.

Backstairs Passage, the narrow strait that separates Kangaroo Island from the mainland, may have originated in one of two ways. There can be little doubt that the high flat surface of the island is a continuation of the peneplain of the

(4) Compare R. Tate, Trans. Roy. Soc., S.A., 1884-5, pp. 56-7; also E. C. Andrews, Geographical Unity of Eastern Australia, Proc. Roy. Soc., N.S.W., 1910, especially p. 440.

(5) R. Tate, Proc. Roy. Soc., N.S.W., 1888, p. 242.

(6) W. Howchin, Trans. Roy. Soc., S.A., 1898, p. 15-6; also present volume *ante* pp. 55-6 and pl. x. (inset).

(7) See present volume, *ante*, pp. 47-59.

(8) W. Howchin, Report of the Australasian Association for the Advancement of Science, 1907, p. 267; also Trans. Roy. Soc., S.A., 1910, p. 1 and p. 231.

(9) W. Howchin, present volume, p. 53.

mainland. That its extension is in a westerly direction rather than southerly, parallel to the Mount Lofty Ranges, cannot be due primarily to the original Palæozoic folding, the axis of which also bends in a similar fashion; but it may be due to it, secondarily, in that the bounding fault-scarps have developed parallel to the folding planes of the rocks, as in the case of the Mount Lofty Range itself The most obvious explanation of the passage is that it is a senkungsfeld, *i.e.*, an area dropped down between two fault-planes, respectively the southern scarp of the main range and the northern of the island. The Pages might be considered as the tops of a sunken residual. But in the case of the Inman, Hindmarsh, and Upper Finniss Valleys it is clear that their great maturity is due to the fact that they were carved by the Permo-Carboniferous glaciers and filled with their soft till. This has been quickly removed when first exposed to the attack of streams, rejuvenated by the uplift. Might it not also be suggested that the Backstairs Passage was a wide glacial valley filled with till, which has been subsequently almost entirely removed by stream and marine erosion? Several facts are in support of this. The base of the valley must, of course, have been below sea-level; but so is that of the Inman glacier at Victor Harbour. The researches of Mr. Howchin [10] have shown the strongly glaciated nature of portion of the southern scarp of the mainland, and he has proved the presence of glacial boulders near Cape Jervis.[11] He has also described Permo-Carboniferous glacial till on northern Kangaroo Island.[12]

The depression is thus bounded on both sides by glacial material and, in places, striated surfaces—facts strongly in support of the second hypothesis. It is, of course, possible that block-faulting may have assisted in the formation of the passage, but the author's inclination is to give it a minor rôle. On the glacial hypothesis The Pages should be roches moutonnées. The Admiralty soundings are of little help in deciding the question, as they show only that a flat bottom exists in the passage at a depth of less than 20 fathoms.

The drainage alterations during the various periods of earth movement require much further study. Rivers were captured, as the heads of the Onkaparinga by the Torrens,[13]

(10) Trans. Roy. Soc., S.A., vol. xxxiv., 1910, p. 1, pls. i. to xvii.

(11) Rep. Aus. Asso. Adv. Science, vol. vii., 1898, p. 124.

(12) Trans. Roy. Soc., S.A., vol. xxiii., 1899, p. 198, pls. iv. and v.

(13) This conclusion, though reached independently by the writer, has been, he finds, Mr. Howchin's view for some time.

or revived with the formation of valley in valley structure, as in Foreston Creek, near Gumeracha; or they were reversed altogether. Sixth Creek, flowing north from Uraidla into the Torrens, seems to be a reversal of Cox's Creek flowing south into the Onkaparinga. Further, the uplift and consequent entrenchment and headward extension of the east and west valleys (entrenched meanders of the Torrens River) brought about the capture and reversal of portions of the meridional streams. An excellent example of this was noted in Millendella Creek, near Palmer, by Mr. Howchin and the writer. The former has a full description of it in preparation. Other examples are shown by Rocky Gully,(14) near Murray Bridge, Mount Barker Creek, Bull's Creek, etc. The recurrence of earth movements at several periods probably accounts for many puzzling features in the present drainage, particularly the course of the Lower Onkaparinga. The occurrence of its present valley cutting across the middle of the southward sloping, Claiendon-Aldinga block, is very remarkable. Mr. Howchin has shown that an older mouth lies considerably south of its present opening.(15)

Many further problems await solution in this area, which is one of the most interesting geologically and physiographically in Australia.

The writer's thanks are due to Mr. Howchin for his ever-ready assistance and information freely given.

Geological Department,
Sydney University,
March, 1911.

DESCRIPTION OF PLATES.

Plate XX.

Stereogram of the Mount Lofty Ranges

Plate XXI.

Map of the Mount Lofty Ranges to show the drainage system. Notice how the original meridional drainage, the streams of which are in matured valleys, has been broken into numerous watersheds by capturing east and westerly gorges, developed consequent upon the uplift of the range. Mark particularly the Wakefield, Light, Rhine, and Onkaparinga systems and their relation to the lines of faulting. These faults have an easterly downthrow on the eastern side and a westerly on the western. The ends of the fault-lines shown are points beyond which they have not been traced, or appear to pass into monoclinal folds, or to die out. The doubt as to the scarp nature of the southern coast is explained in the text.

(14) W. G. Woolnough, Trans. Roy. Soc., S.A., 1908, p. 124.
(15) Geography of South Australia, p. 124.

Revision of the Australian Hesperiadæ.

By Oswald B Lower, F.Z.S., F.E.S., Etc.

[Read August 10, 1911.]

Introduction.

Since Mr. Meyrick and myself gave our Revision of this group (Trans. Roy. Soc., S.A., vol. xxvi., p. 38, *et seq.*) many new forms have been discovered and the synonymy of others further corrected, consequently no excuse is necessary for a further revision of this difficult yet fascinating group. In dealing with the present monograph I have not deviated perceptibly from the arrangement laid down in the former paper. The neural characters and antennal structure, together with the peculiarities of palpi, have been made use of where expedient. In recent years Scudder and Elwes have advanced their theory of classification by utilizing the genitalia as a means of discrimination—in fact, Elwes has considered this system of paramount importance in characterizing the different species. I am not averse to the utilization of these characters when of value or in doubtful species, but prefer keeping to our original arrangement.

When we become better acquainted with the earlier stages of the various species I hazard the opinion that the present arrangement will require considerable alteration, but as yet we are acquainted with so few that nothing satisfactory can be promulgated in this direction. What knowledge I possess in the matter indicates interesting results. The various pupæ known to me present generic peculiarities which promise to be of particular value in generic distinctions. Whether they can be used to advantage in future remains to be seen. At present I have an open mind on the question, which is better than formulating an hypothesis which would fashion matters to assimilate with preconceived ideas, as frequently the latter method promotes useless disputes over minor details and narrows the mind to indulge in acrimonious personalities which are devoid of value, excepting perhaps to make confusion confounded. For instance, one could form several new genera for the reception of species under *Hesperilla*, but the problem is too complex to be finally disposed of with the knowledge we at present possess of the various known species. I have erected new genera where I have considered it necessary and have submerged others when indicated.

Whether we have several small genera or one large section is purely a matter of individual opinion, and unless there is a distinctive generic peculiarity I prefer the larger genera, as fully three-fifths of the species enumerated in this paper are endemic. The most troublesome and least understood group are *Telicota* and the allied genera, and progress must necessarily be slow, as no satisfactory arrangement can be maintained until an exhaustive examination is accomplished by the accumulation and dissection of a large quantity of material from the Indo-Malayan region. The geographical range which I consider Australian is the continent proper and Tasmania. In the near future I intend to prepare a paper which will embrace structural characters, etc., coloured figures of larvæ, pupæ, and imagines, and will endeavour to place my New Guinea and material from the adjoining islands in the proposed work, in which I hope to receive the same generous assistance from my co-workers.

I have unsuccessfully endeavoured to locate many of the types. This applies more especially to those of Plötz, and have been reluctantly compelled to abandon the search. Many of Plötz's species are in the collection of the late Herr Erhardt at Munich.

Before concluding I would take this opportunity of heartily thanking Colonel Chas. Swinhoe, Messrs. J. A. South, H. J. Elwes, Bethune Baker, H. Druce, A. Bang-Haas, Herr Krepelin, G. A. Lyell, and many others for assistance, not forgetting Mr. G. A. Waterhouse, whose valued help has been of yeoman service to me in the elucidation of many knotty points.

1. Casyapa, Kirby.

Casyapa. Kirby, Syn., Cat., Diur., Lep., p. 576, 1871. *Chætocneme*, Feld., Sitz., A. K. Wiss, Math. Cl., vol. xl., p. 460, 1860 (*nom præocc*). *Casyapa*, Watson, P.Z.S., p. 29, 1893; M. and L., T.R.S., S.A., vol. xxvi. p. 40.

Club of antennæ moderate, gradually thickened, tapering to a fine point, bent, not hooked. Forewings in male with costal fold; vein 5 equidistant from 4 and 6; 3 from well before end of cell; 2 three times as far from base of wing as from end of cell. Hindwings with termen evenly rounded; 5 obsolete; 3 from just before end of cell. Hind tibiæ densely fringed and with only terminal part of spurs.

Type *corvus*, Feld.

This genus differs from *phœnicops*, Watson, by the presence of costal fold of ♂. The genus extends to the Indo-Malayan Archipelago.

1. C. CARISTUS, Hew.

Chaetnocneme caristus, Hew., Desc. Hesp, p. 21; *Casyapa critomedia*, M. and L. (*nec* Guer), T.R.S., p. 40.

The description given as above refers to this species and not to *Critomedia*, Quer. This latter species does not, so far as I am aware, occur in Australia. The two specimens of *caristus* in the Miskin collection (said to have been taken by the late Mr. Diggles at Kangaroo Point), the two ♂ specimens in my own collection from Cape York, and two in Mr. Bethune-Baker's collection (taken in New Guinea) are identical.

Type in Coll. Hewitson (British Museum).

2. PHŒNICOPS, Watson.

P.Z.S., p. 30, 1893; M. and L., T.R.S., p. 41.

Club of antennæ moderate, elongate, gradually thickened, pointed, bent, not abruptly angled. Palpi ascending, terminal joint very short, obtuse. Posterior tibiæ without middle spurs. Forewings in male without characters, 5 parallel to 4 and 6, slightly nearer to 6 at base. Hindwings with 5 obsolete.

Type *beata*, Hew.

An endemic genus, comprising the three largest and most beautiful species in the Australian group.

2. P. BEATA, Hew.

Netrocoryne beata, Hew., Desc. Hesp., p. 22, 1867. Ex. Butl., v. Hesp., figs. 2, 3, 1874; M. and L., T.R.S., p. 41.

Type in Coll. Hewitson (British Museum).

I have received several specimens from Mr. F. P. Dodd taken and bred at Kuranda, Queensland, in May, September, October, and November. It also occurs from Brisbane to Cooktown, and at Richmond River (Waterhouse) and at Mount Kembla (A. G. Hamilton).

P. DENITZA, Hew.

Netrocoryne denitza, Hew., Desc. Hesp., p. 22, 1867; ex. Butl., v. Hesp., fig. 4, 1874; Stand., ex. Schmett, pl. c., 1888; *Phœnicops denitza*, M. and L., T.R.S., p. 42.

Type in Coll. Hewitson (British Museum).

Brisbane to Cooktown, Queensland, and Port Darwin; December to March.

3. P. PORPHYROPIS, M. and L.

T.R.S., p. 43.

Types in Coll. Lower.

I have received several fine specimens of both sexes of this species from Mr. F. P. Dodd taken at Kuranda, Queens-

land, in October and February. The ♀ does not differ from the ♂ in markings: the ♂ appears to have an indistinct costal fold. In some specimens it may appear more perfectly developed. Should such prove to be the case, the species will be required to be placed in *casyapa*. The present species is very similar to the New Guinea species, *Kallima*, Swinh. (A.M.N.H. (7), xx., p. 430, 1907, and T.E.S., p. 3, pl. i., fig. 1, 1908), but differs by the presence of the yellow patch on termen of hindwings. The type of *porphyropis* came from Johnstone River, North Queensland.

3. NETRO CORYNE, Feld.

Reis., Nov., Lep. iii., p. 507, 1867; M. and L., T.R.S., p. 43.

Type *repanda*, Feld.

Club of antennæ elongate, pointed, bent. Palpi porrected, terminal joint rather short, obtuse. Posterior tibiæ with all spurs. Forewings in ♂ without stigma or costal fold; 5 parallel to 4 and 6. Slightly nearer 6 at base. Hindwings with 5 obsolete. Confined to the Australian region.

4. N. REPANDA, Feld.

Reis., Nov., Lep. iii., p. 507, pl. lxx., fig. 10, 1867; Math. T.E.S., 1888, p. 181, pl. vi., fig. 5; M. and L., T.R.S., p. 43. *Goniloba vulpecula*, Prittw., S.E.Z., p. 187, pl. iii., figs. 2*ab*, 1868.

Type in Coll. Felder.

Sydney to Cooktown. Mr. Dodd has sent several specimens bred at Kuranda, North Queensland: between November and March.

The larvæ feed on *Callicoma serratifolia*, *Elæocarpus cyanea*, and *E. reticulatus*.

4. TAGIADES, Hüb.

Verz., Z., p. 108, 1816; M. and L., T.R.S., p. 45. *Pterygospidea*, Wallgr., Rhop., Caffr., p. 53, 1857.

Club of antennæ slender, gradual, elongate, bent, apiculus rather long, pointed. Palpi porrected, terminal joint short, obtuse. Posterior tibiæ with all spurs. Forewings in male without characters; 5 parallel to 4 and 6, slightly nearer to 6 at base. Hindwings with 5 rudimentary, very faint.

Type *japetus*, Cr. *(Tagiades)*; type *flesus*, Fabr. *(Pterygospidea)*.

Chiefly confined to the Indo-Malayan and Asiatic regions.

Note.—Since writing the above I submitted authentic specimens of *Tagiades gamelia*, Misk., to Colonel Swinhoe, who returned them as *louisa*, Swinh. The same specimen was

afterwards submitted to Mr. Herbert Druce, who compared it with specimens of *Janetta*, Butl., in the Godman collection (British Museum), and he states that they are undoubtedly one and the same species. The synonymy will therefore be:—

T. JANETTA, Butl.

T.E.S. Lond., p. 519, 1870; *T. gamelia*, Misk., P.R.S. Qld., 1889, p. 146; *T. australensis*, Mab., C.R. Ent., Belg., xxxv., p. 72; *T. louisa*, Swinh., Ann. Mag. Nat. His. (7), xx., p. 432, 1907.

108. *Padrasna suborbicularis*, Mab.

109. *Ocybadistes suffusus*, *Mab.*

These two new species were recently described in Wystmarnis Gen. Insect. I am not acquainted with either. The locality given is Australia.

The *Tagiades* are sombre-coloured insects showing slight geographical variations; the Australian forms and those of the adjoining islands are closely allied and probably derived from *japetus*, Cr. They are, however, separated from that group by the snow-white hindwings, of which I consider *atticus*, Fabr., the earliest form. As it is highly probable that *janetta*, Butl., will be taken on the mainland and may ultimately prove to be identical with *gamelia*, Misk., I append both of the original descriptions.

5. T. JANETTA, Butl.

T.E.S., Lond., p. 519, 1870; M. and L., T.R.S., p. 45.

Front wings dark-brown; a streak at end of cell and another on the disc, grey scales, four central spots, two within the cell and two between the median branches, and five points near the apex in a recurved series, white hyaline; hindwings, the basal area, and apex dark-brown, two large black spots placed obliquely within the apical band; body brown. Frontwings below nearly as above, the grey discal streak broader and well defined, becoming white near anal angle; hindwings white, costa and apex dark-brown; subapical spots as above; a black triangular spot at end of median branch and a short black line at the end of second; white; body, greyish in front, white behind.

Expanse of wings, 2 in.

Hab.—Aru Islands.

Coll. Druce. Belongs to *Japetus* group (Butler, T.E.S., Lond., p. 519, 1870).

T. gamelia, Misk., P.R.S., Qld., 1889, p. 146.

♂ ♀. $1\frac{8}{12}$-$1\frac{10}{12}$ in. Upper side pale-brown with 9 pale colourless transparent spots, 2 within and at end of cell, 2

others below and slightly beyond these, and a series of 5 very small ones forming a bent row a short distance from and parallel with apex. Hindwings with the basal and apical area pale-brown, rest of wing pure white, with two quadrate black patches near apex, upper one being the least. Under-side of forewings as above with a whitish patch near hinder angle. Hindwings all white with apical angle broadly towards base dark-brown: 2 brown patches near apex, of which the upper is the largest; a short line of brown close to outer margin, not reaching anal angle or extending to termination of median, base of wing with a bluish tinge. Thorax and abdomen above pale-brown, beneath light-grey.

Cape York, Queensland. Allied to *Japetus*, Cr., which it resembles somewhat on under-side. The sexes do not differ.

Butler does not give the colour of hindwings above, nor does he state the sex (it is probably a female). In some specimens the two cellular marks are separate above, but joined on under-side by a fleck of whitish; this peculiarity occurs irrespective of sex. Mr. Waterhouse has sent me specimens of *gamelia* in which the ♂ measures but 45 mm. These were taken on Prince of Wales Island during June; the mainland specimens are slightly larger, ranging up to 50 mm.

Cape York, Queensland; also from Prince of Wales Island.

6. T. LOUISA, Swinh.

Ann. Mag., N.H. (7), xx., p. 432, 1907; T.E.S., Lond., p. 6, fig 5, pl. i. (1908).

Types in British Museum.

♀. 2 in. Exp. Blackish-brown, palpi white beneath, frons with a white spot on each side; forewings with two large hyaline spots at end of cell, one outside its lower angle and another close beneath it, all more or less triangular, a subapical row of six small spots in the usual recurved line; hindwings with about one-half the lower portion white, the white running up the abdominal margin to the base; two very large black spots in the middle of the disc, touching the inner-side of the outer curve of the brown portion of the wing; no marginal marks or spots; under-side with two additional hyaline spots on the forewing near the hinder angle; hindwings with a somewhat narrow black costal border; the two discal spots much smaller and one minute black mark on the outer border below the middle. Legs and body white. (Swinhoe, A.M.N.H. (7), xx., p. 432, 1907.)

Rossel Island; also from Cape York.

As will be seen by the above, *louisa* only differs from *gamelia* by having 6 instead of 5 subapical spots. I very much

doubt if the species can stand as distinct, as I possess a specimen of *gamelia* with an additional subapical spot, and although the insect is smaller, it could be considered either species. Probably a longer series will connect the forms as being one and the same.

7. T. GAMELIA, Misk.

P R.S . Qld., 1889, p. 146. *T. Australensis*, Mab., C.R., Ent. g., xxxv., p 72. *T. janetta*, M. and L. (*nec* Butl.), T.R.S., p. 45.

Type *gamelia*, in Queensland Museum; type *Australensis*, in (?) Coll. Staudinger.

We formerly called this species *janetta*, Butl., and although the descriptions are similar it appears that *janetta* differs from *gamelia* by the hindwings. Mabille's description of *Australensis* certainly indicates *gamelia*.

Cape York, Queensland, and Prince of Wales Island, in June.

5. MESODINA, Meyr.

Ent. Mon., Mag., xxxvii., p. 168, 1901; M. and L., T.R.S., p. 46.

Club of antennæ elongate, pointed, bent, sub-porrect, apiculus very short. Posterior tibiæ without middle spurs. Forewings in male without stigma; 5 parallel to 4 and 6, slightly nearer 6 at base. Hindwings, 5 obsolete.

Type *œluropis*, Meyr.

This genus differs from *Hesperilla* only by the absence of stigma of forewing and absence of middle spurs of posterior tibiæ, which latter character also separates it from *Trapezites*, Hüb.

8. M. ÆLUROPIS, Meyr.

Ent. Mon., Mag., xxxviii., p. 168, 1901; M. and L., T.R.S., p. 46.

In the former Revision the reference was inadvertently given as an M.S.S. name, but was described as above.

Mr. Waterhouse informs me that this is a mountain species, and so far has been bred only in October to December, and again early in January.

Type in Coll. Meyrick.

9. M. HALYZIA, *Hew.*

Hesperilla halyzia, Hew., Desc. Hesp., p. 38, 1868; ex. Butt., v., figs. 4-6, 1874; Vict., Butt., ii., p. 125, 1894; M. and L. T.R.S., p. 47

Mr. Jarvis, the Entomologist to the Government Museum at Brisbane, informs me that he took this species on

Moreton Island, Queensland, in October. This is a new locality, and extends the range of this species considerably. Mr. Miskin, in his catalogue, gives Mackay and Bowen as localities, but as pointed out previously the insect referred to was *tyrrhus*, Mab. (*Bathrophora*, M. and L.).

Sydney, New South Wales, October to April.

Type in Coll Hewitson (British Museum).

10. M. HALYZIA, Hew., *var.* CYANOPHRACTA, *nov. var.*

♂ ♀, 28-36 mm. Head, thorax, palpi, and abdomen dark-fuscous, mixed with golden-ochreous hairs on thorax and abdomen; thorax and abdomen beneath mixed with bluish-white. Legs bluish-white. Antennæ fuscous, annulated with white, apiculus reddish. Forewings elongate, triangular; costa somewhat sinuate in middle, termen oblique, in ♀ more strongly bowed; dark ochreous-fuscous; markings ochreous-whitish; a large, somewhat quadrate spot in end of cell, excised internally, outer edge straight; a cartridge-shaped spot beneath and beyond, beneath which is another similar spot, separated by vein from former spot; an oblique transverse row of 3 subapical spots *present in both sexes;* cilia fuscous, basal half darker, somewhat barred. Hindwings with termen rounded, somewhat prominent in ♂ above middle, colour and cilia as in forewings. Forewings below blackish-fuscous, markings of upper side reproduced, upper half of termen and apical area bluish-white, some orange scales in basal half of cell. Hindwings bluish-grey; a faintly produced curved series of postmedian fuscous rings, absent in some specimens; cilia of all wings bluish-grey, that of forewings being more or less barred with fuscous.

Whether this insect can be raised to the rank of a species or simply remain as a variety of *halyzia* remains to be seen. I have 2 ♂ and 3 ♀ specimens, and have seen others, and the 3 subapical spots on forewings and peculiar bluish-whitish colouring of under-side appears on the whole of the specimens.

In true *halyzia* the subapical spots of ♂ *are very rarely present,* although I have a single ♂ specimen, probably taken at Sydney, in which the 3 spots are feebly developed. I have not seen Victorian specimens of *halyzia*, but Mr. Waterhouse gives that locality.

When the life history of *cyanophracta* is elucidated it will probably be found necessary to further consider the question. The five specimens under review were all taken at Perth, Western Australia, in November.

Types in Coll. Lower.

6 MOTASINGHA, Watson.

P.Z.S., p. 73, 1893

Club of antennæ robust, bent, apiculus blunt. Palpi obliquely ascending, subporrect terminal joint short, subconical. Posterior tibiæ with all spurs. Forewings in male with stigma; 5 parallel to 4 and 6, slightly nearer 6 at base. Hindwings, 5 obsolete.

Type *dirphia*, Hew.

This genus differs from *Hesperilla* by the shape of club of antennæ and from *Mesodina* by the presence of discal stigma of ♂ and presence of all spurs on posterior tibiæ.

11. M. DIRPHIA, Hew.

Desc. Hesp., p. 38, 1868; ex. Butt., v., figs. 1-3, 1874; M. and L., T.R.S., p. 60. *H. trimaculata*, Tepp., *l.c.*, 1881, p. 32, pl. ii., fig. 1. *H. quadrimaculata*, *ib.*, *l.c.*, pl. ii., fig. 2. *Motasingha dirphia*, Watson, P.Z.S., 1893, p. 73.

Western Australia, South Australia, Victoria, and New South Wales. Thirty-three specimens; November to March. I think the former locality quoted, *i.e.*, Cape York, is erroneous; at all events, it requires verification. The antennæ of this species has the apiculus very obtuse.

Type *dirphia*, in Coll. Hewitson (British Museum); types *trimaculata* and *quadrimaculata*, in Coll. Adelaide Museum.

7. HESPERILLA, Hew.

Desc. Hesp., p. 37, 1868. *Telesto (nom præocc)*, Bdv., Voy, "Astrolabe," Lep., p. 164, 1832; Plotz, Stett, Ent., Zeit, 1884, p. 376; M. and L., T.R.S., p. 48. *Oxytoxia*, Mab., Wyst. Gen. Ins.

Club of antennæ elongate, more or less bent, apiculus acute, moderate. Palpi obliquely ascending or subporrect, terminal joint short, rarely moderately long, subconical. Posterior tibiæ with all spurs. Forewings in male with stigma; 5 parallel to 4 and 6, slightly nearer 6 at base. Hindwings, with 5 obsolete.

Type *ornata*, Leach; *Hesperilla*, Hew.; type *perroni*, Latr.; *Telesto*, Bdv.; type *Doubledayi*, Feld.; *Oxytoxia*, Mab.

We formerly placed all the following species in *Telesto*, Bdv., but as this name has been used in *Tubularina*, in 1812, and again in *Crustacea*, in 1814, I am adopting Hewitson's name in preference to Boisduval's. With the exception of *perornata*, Kirby, and *munionga*, Oll., the genus is immediately separated from *Mesodina* and *Trapezites* by the absence of stigma in male. I have merged *Oxytoxia*, Mab., into *Hesperilla*, as to all intents and purposes it is structurally identical with that genus. A somewhat discordant character in

the genus *Hesperilla* is the slight structural differences in the antennæ and palpi, but at present I see no reason for dividing the genus any further than I have done. When we become better acquainted with the earlier stages of the different species, it may be advisable to erect new genera where expedient, but as they form a tolerably compact group, and are (with one or two exceptions) peculiar to the Australian region, I prefer to retain them under the one genus.

Watson distinguishes *Hesperilla* from *Telesto* by the latter having "club arcuate without terminal crook," whereas in the latter genus he considers the club "usually bent to less than a right angle." *Peroinata* and *munionga* will probably require a new genus to receive them, as in characters they appear to be intermediate between *Hesperilla* and *Trapezites*, having the facies of the former and characters (in a degree) of the latter. In this and the following genus I have adopted a somewhat different arrangement from that in our previous paper, as it appears to be more in keeping with the proper sequence of the various species.

Mabille's genus *Oxytoxia* was erected on the strength of the stigma of male being oblique instead of erect, a rather feeble effort and quite unnecessary. The suggestion to form a new genus for *Doubledayi*, *flammeata*, and a few others came from Watson (P.Z.S., 1893, p. 74). By some mischance Mabille has made *flammeata* a synonym of *Doubledayi*, but the stigma of *flammeata* is certainly widely different from the others in places in his genus, *i.e.*, *Doubledayi*, *parvulus*, *compacta*, *argento ornatus*, and (?) *croites*. The last-named two are referable to *Anisynta*.

12. H. CYCLOSPILA, M. and L.

Telesto cyclospila, M. and L., T.R.S., p. 63.

Port Lincoln, South Australia; Melbourne, Victoria; in November.

Types in Coll. Lower.

13. H. CHRYSOTRICHA, M. and L.

Telesto chrysotricha, M. and L., T.R.S., p. 59.

Since the former Revision appeared I have received the ♀ taken at Rottnest Island, Western Australia. I append description of same.

♀, 42 mm. Head, palpi, antennæ, thorax, legs, and abdomen ochreous-fuscous; head, thorax, and abdomen clothed with yellowish hairs. Forewings elongate, triangular, termen slightly bowed, oblique; dark fuscous, silvery-whitish markings; a large, somewhat quadrate spot in end of cell, broadest above, slightly yellowish tinged, in end of cell; a

cartridge-shaped spot at base of veins 3 and 4, and a moderately large quadrate one immediately below; an oblique row of 3 subapical spots; a semi-ovoid spot lying on vein 1, at ⅔ from base; cilia dark-fuscous. Hindwings with termen rounded, colour and cilia as in forewings; a rather large median patch of orange scales, divided into 3 unequal portions by veins, basal hairs orange; under-side of forewings reddish ochreous; markings of upper-side reproduced; basal ⅔ of cell clothed with short orange hairs; dorsal edge pale-yellow, more broadly at anal angle. Hindwings reddish; marking dull silvery-white, edged with fuscous; a roundish spot in posterior end of cell; a similar spot at ⅔ from base, between veins 6 and 7, and 2 similar, between veins 2 and 4; indications of similar spots adjoining.

Types in Coll. Lower.

Albany and Rottnest Island, Western Australia; in November. Mr. Meyrick has it from Northampton, Western Australia, and I possess what is probably a worn ♀ of this species from Goolwa, South Australia, taken in March.

14. H. DONNYSA, Hew.

Desc. Hesp., p. 39, 1868; ex. Butl., v., fig. 7, 1874; Victorian Butterflies, ii., p. 122, 1894. *Telesto donnysa*, M. and L., T.R.S., p. 64. *Hesperilla Rietmanni*, Semp., Mus. God., xiv., p. 187, 1878.

Watson and Swinhoe suggest forming a new genus to receive this species. I have placed *Rietmanni*, Semp., as a synonym of this species, but am not perfectly satisfied as to its being identical. Semper's description applies fairly well to *donnysa*, excepting the size and the yellow *longitudinal* streak (which may probably be intended for the scales along the dorsum). Judging by the figure I have of *croites*, Hew., that species is *very* similar to the ♀ *chaostola*, Meyr., but the ♂ of *chaostola* can hardly be considered to approach ♂ *picta*, Leach, with which *Rietmanni* is compared by Semper. *Donnysa* is the only *Hesperilla* that I am acquainted with which shows the 6 white spots on border, and I know of no other Sydney species which approaches Semper's description better than *donnysa*, consequently I treat it as a synonym of that species. I have made diligent inquiries, but have been unable to trace Semper's types. I append Semper's original description:—

"HESPERILLA RIETMANNI, Semper, *nov. spec.* Erhalten von Sydney, im Februar, gefangen Flugellänge: ♂, 12 mm.; ♀, 13 mm. Das ♂ ähnelt oberseits auf den Vorderflügeln der vorigen Art, nur hat der noch senkrechter auf den Innenrand des Flügels stehende Wulst einen gelben Längs-

strich. Die Hinterflügel sind einfarbig dunkelbraun mit einem gelblichen Schimmer auf dem Discus. Auf der Unterseite ist die Wurzelhälfte der Vorderflügel gelbbraun, der Innenrand grau und der grössere Theil des Aussenrandes dunkelbraun mit violet angeflogener Flugelspitze. Die Hinterflügel sind violetbraun mit hellerer undeutlicher Mittelbinde.

'Das ♀ sieht oberseits wie *Cycl. croites*, Hew. (ex. Butl., v. Cycl. and Hesp., fig. 14) aus, nur fehlt der helle Wurzelfleck auf den Vorderflügeln: und der gelbe Mittelfleck auf den Hinterflügeln ist kleiner. Auf der Unterseite ist die Zeichnung wie beim ♂, nur etwas heller und im Ganzen scharfer ausgeprägt; so besonders die hellere Mittelbinde auf den Hinterflügeln, welche wurzelwärts mit einem und saumwart mit einer Reihe von sechs kleinen weissen Punkten begrenzt ist." The "preceding species" which Semper compares *Rietmanni* with is picta, Leach.

I have recently seen specimens of *donnysa* taken at Mount Wellington, Tasmania, in which the markings of upper-side of wings are considerably enlarged and the colouring much brighter: the median patch of hindwing above deep-orange, and the spots of under-side are larger and distinctly white-centred. It may be advisable to give this a varietal name, but until more material is available I will consider it a well-marked form.

Victoria, Tasmania, South Australia (Blackwood and Yatala), Sydney, etc., New South Wales; from November to January.

15. H. IDOTHEA, Misk.

♀, *Trapezites idothea*, Misk., P.R.S., Qld., 1889, p. 152; Vict., Butt. ii., p. 116, 1894; *Telesto idothea*, M. and L.; T.R.S., p. 68. ♂, *Telesto dispar*, Kirby, Ann. Mag., N.H., 1893, p. 436; Vict., Butt. ii., p. 117, 1894.

The sexes of this species are very dissimilar, but admit of no doubt of their being one and the same. My brother (Mr. Harold Lower) took several *male* specimens at Mount Lofty, South Australia, at about 7 *a.m.*, without observing the ♀.

Tasmania, Victoria, Blue Mountains, New South Wales; Mount Lofty, South Australia; in November and December.

Type ♀ in Coll. Miskin (Brisbane Museum); type ♂ in Coll. British Museum.

16. H. FLAMMEATA, Butl.

♂, *Telesto flammeata*, Butl., Ann. Mag., N.H., 1882, p. 85; Vict., Butt. ii., p. 124, 1894; M. and L., T.R.S., p. 69. ♀, *Telesto eclipsis*, Butl., Ann. Mag., N.H., 1882, p. 86; *Hesperilla atromacula*, Misk., P.R.S., Qld., 1889, p. 148.

Healesville, Gisborne, etc., Victoria; Sydney, New South Wales; in January and February.

Types *flammeata* and *eclipsis*, in British Museum; type *atromacuta*, in Brisbane Museum.

17. H. TYMBOPHORA, M. and L.

♂, *Telesto tymbophora*, M. and L., T.R.S., p. 70. ♀, *l.c.*, 1908, p. 312.

Type ♀ in Coll. Waterhouse; type ♂ in Coll. Lower.

Mr. Waterhouse considered the ♀ to be *arsenia*, Plötz, but that species is identical with ♀ *Perroni*, Latr.

Mount Kembla, New South Wales; in December.

18 H. COMPACTA, Butl.

Ann. Mag., N.H., 1882, p. 87. *Telesto compacta*, M. and L T.R.S., p. 77. *Hesperilla scepticalis*, Rosen., Ann. Mag., N.H , 1885, p. 379, pl. ii., fig. 2. ♂, *Hesperilla melissa*, Mab., Comp., Rend., Ent. Belg., vol. xxxv., p. 81, 1891. ♀, *Hesperilla atrax*, Mab., *l.c.*, 1891.

I sent ♂ and ♀ of this species to Mabille. He identified the ♂ as *Hesperilla melissa*, Mab., and the ♀ as *Telesto compacta*, Butl., consequently the question arises what species does *his* ♀ *melissa* represent? Of his *melissa* he says:—

"Noir; à reflet roux; ailes portant un trait presque en croissant dans la cellule, trois points à l'apex et une petite dans le 4^{e} intervalle, tous blancs et vitrés. Inférieures avec une rangée de 4 taches allongées, vitrées sur le milieu, la supérieure plus petite, et un point roux clair (deux chez la ♀) à la base de la cellule. Franges roux clair, dessous des ailes avec les taches du dessus, mais le fond est brun rougeâtre clair, excepté le milieu des supérieures qui est noirâtre, et l'intervalle I., qui est blanc roussâtre. Aux inférieures la bande du milieu à deux points roux cèrcles de noir qui lui font suite sur les intervalles 3 et 2; et un autre semblable sur l'intervalle 7. En outre il y a sur la base de l'aile une rangée de trois points blanc roussâtre, et un autre à la base de l'intervalle 8.

"Le Corps est de la couleur des ailes; en dessous les palpes et la poitrine sont blanc; 21 mm., ♂ et ♀, Sydney."

The description of the male admits of no doubt, although no mention is made of the stigma, unless "un trait presque," etc., refers to it; but I take that to refer to the elongate subcrescentric mark in cell of forewing. I have a coloured drawing of the *type specimen* of *atrax*, and it is without doubt the ♀ of *compacta*, Butl.

Sydney, etc., New South Wales; Macedon, Gisborne, etc., Victoria; from February to April.

Types *compacta*, in British Museum: types *melissa* and *atrax*, in Coll. Berlin Museum (Staudinger's).

19. H. ANDERSONI, Kirby.

Telesto Andersoni, Kirby, A.M.N.H., p. 434, 1893; Vict., Butt., ii., p. 118, 1893; M. and L., T.R.S., p. 66.

Type in British Museum.

Dandenong Ranges and Poowong, Victoria; Mount Kembla, New South Wales; in November and January.

20. H. DOUBLEDAYI, Feld.

Telesto Doubledayi, Feld., Verh., Zool., Bot., Ges. xii., p. 491, 1862; Vict., Butt. ii., p. 126, 1894; M. and L., T.R.S., p. 72. *Hesperilla dirphia*, Herr.-Sch. (*nec* Hew.), S.E.Z., 1869, p 79, pl. iii., fig. 10. *Telesto Leachi*, Feld., Verh., Zool., Bot., Ges. xii., p. 491, 1862. *Telesto extranea*, Plötz, S.E.Z., p. 383, 1884.

As will be seen an additional synonym is *extranea*, Plötz.

Brisbane to Cairns, Queensland; Como (Sydney), New South Wales; Healesville and Wandon, Victoria; from November to March.

21. H. LEUCOSTIGMA, M. and L.

Telesto leucostigma, M. and L., T.R.S., p. 73.

Types in Coll. Lower.

Sydney, New South Wales, to Cairns, Queensland.

22. H. LEUCOSTIGMA, M. and L., *var.* PARASEMA, Low.
T.R.S., S.A., p. 312, 1908.

Differs chiefly from typical *leucostigma*, M. and L., by the absence *in both sexes* of the sickle-shaped cellular spot, which is never more than faintly indicated. The 3 subapical spots are absent in both sexes, and the lower post-stigmal dot is sometimes absent.

Types in Coll. Lower.

Kuranda, Queensland. Several specimens sent me by Mr. Dodd; taken in November and December.

23. H. PARVULUS, Plötz.

Telesto parvulus, Plötz, S.E.Z., 1884, p. 379. *Hesperilla humilis*, Misk., P.R.S., Qld., 1889, p. 150. *Telesto ismene*, Newm., M.S.S., Vict., Butt., ii., p. 128, 1894; M. and L., T.R.S., p. 73.

We formerly called this *ismene*, Newm., but Colonel Swinhoe informs me that the name was never published. Mr. Kirby and Mr. Heron (of the British Museum) can find no record of it, and Mr. Meyrick can throw no light on the matter. Felder described an insect (Reis. Nov.

iii, p. 512, No. 894, figs. 4 and 5, t. 73, 1867) under the name of *Hesperia ismene* from Celebes, but I am not acquainted with it.

Sydney, etc., New South Wales; Brisbane to Mackay, Queensland: Healesville, Lake Tyers, Victoria; in November.

24. H. SEXGUTTATA, Herr.-Sch.

Telesto sexguttata, Herr.-Sch., S.E.Z., 1869, p. 80, pl. iii., fig. 16. ♀, M. and L., T.R.S., p. 74, Brisbane (?), Bowen, Rockhampton, Herberton, Queensland.

Brisbane (?), Bowen, Kuranda, Rockhampton, Herberton, Queensland.

25. H. MELANIA, Waterh.

Telesto melania, Waterh., Vict., Nat. 1903, p. 54.

♂ ♀, 30-36 mm. Head, palpi, antennæ, thorax, abdomen, and legs dark-fuscous; palpi, thorax, and abdomen beneath whitish: apiculus of antennæ dull-reddish internally. Forewings elongate, triangular, costa straight, termen oblique, hardly rounded; dark-reddish fuscous, without markings; stigma oblique, very narrow, entire, dull-whitish, edged internally with its own width of black, from just above dorsum to base of vein 4, where there appears sometimes a small white dot, generally absent, which in ♀ is slightly larger and with an additional smaller dot below, which is also sometimes absent; cilia whitish. Spotted with fuscous. Hindwings with termen rounded, without markings; colour and cilia as in forewings. Under-side of forewings dark-fuscous, dorsum much lighter, becoming whitish at and above anal angle; spots of upper-side when present reproduced. Hindwing light-brown, suffused with grey; generally a curved series of 7 whitish interneural spots at $\frac{2}{3}$ from base, sometimes absent; cilia of both sexes brownish-fuscous. Nearest *tyrrhus*, Mab., but immediately separable from that species by the form of the stigma, which in that species is very broad. In general appearance not unlike *Erynnis fuliginosa*, Misk., but apart from the different cilia, which in that species is a striking characteristic, it is at once recognized by the neuration of forewings.

Types in Coll. Waterhouse.

Kuranda (Cairns), Queensland. Several specimens; January to April.

26. H. TYRRHUS, Mab.

Toxidia tyrrhus, Mab., Comp. Rend. Soc., Ent. Belg., vol. xxxv., p. 80, 1891. *Telesto saxula*, Swinh. (*nec* Mab.), Ann. Mag., N.H. 7, vol. xvi., p. 614, 1905. *Telesto bathrophora*, M. and L., T.R.S., p. 82.

This insect has been subject to some unnecessary confusion. Mabille, who described a ♀ and considered it to be the ♂, formed the genus *Toxidia* to receive it, which is not warranted. Of the species he says:—

"♂, 25 mm. Ailes noires, côté des antérieures un peu rousse. Celles-ci offrent en outre trois petits points apicaux en ligne droite dont l'intermédiare plus petit, en outre on en voit encore un dans le 4e intervalle. Frange large, concolore et luisante. Inférieures d'un noir foncé. Dessous semblable; intervalle 1, aux premières et une partie du 2e, blanchâtres. Disque des inférieures à reflet violâtre. Palpes et poitrine gris cendré, abdomen égalant les ailes inférieures."

In 1905 Colonel Swinhoe identified it as *Hesperilla saxula*, Mab., and described the ♂ under the name of *saxula*, but which in reality refers to the ♂ *tyrrhus*, excepting that he mentions only 2 subapical spots (there are 3 in typical *tyrrhus*), and added as a footnote:—"Mabille's ♀ type came from Cooktown, and his description fits my examples very well, considering the usual sexual differences." This identification is rather confusing, as the description of *saxula* on under-side of hindwings is nothing like *tyrrhus*, which is practically without markings, and cannot possibly be confused with it. Mabille says of under-side of hindwings of *saxula*:—

"Les inférieures sont noirâtres avec une bande basilaire de deux taches jaunâtre cerchés de brun foncé, et une mediane de taches semblables séparée en deux groupes, l'un de deux taches près de l'angle anterieur, et l'outre commençant au dessus de la cellule et s'arrêtant a l'espace abdominal."

In 1904 Mabille, in his Monograph of the Hesperiadæ in Wystman's Genera Insectorum, fascd., p. 132, put his species *saxula* under Godman and Salvins' genus *Halotis*, with Costa Rica, Central America, as its habitat. *This is probably correct.* Colonel Swinhoe says (Ann. Mag., N.H. 7, xvi., p. 615, 1905).—"In the Biologia Insecta, Lep. Rhop., ii., p. 505, pl. xcv., figs. 42, 43, 44, ♂ (1900), a Hesperid from Costa Rica is described and figured as the type of the genus *Halotis*; but neither the description nor the figures represent the Queensland insect. One of the Biologia examples, it is said, is labelled as having been compared by Salvin with the type of *Hesperia saxula*, Mab., a description of which *could not be found*; this must refer to some Hesperid from Costa Rica, so named by Mabille, which never was described and published. It can have no reference to the Cooktown insect."

As mentioned above, the insect has been described, and I have received a fine coloured drawing by R. Flanderky, per favour Trustees of Berlin Museum, which decides the question beyond any doubt, as the drawing delineates a species *totally* dissimilar to *tyrrhus*, and not near anything found in Australia so far as known to me. As the former description embraced two forms I will redescribe the species.

♂, 28 mm. Head, palpi, thorax, and abdomen blackish-fuscous, mixed with greenish-golden hairs, palpi and thorax beneath whitish. Antennæ fuscous, spotted beneath with whitish, apiculus whitish. Forewings elongate, triangular, costa gently arched, termen gently bowed, oblique; dark-fuscous, with a greenish-golden sheen; without markings or very rarely with 3 subapical dots; stigma entire, rather broad, whitish, sometimes appearing white, oblique, edged narrowly on either side with blackish from above vein 1 to posterior extremity of cell, anterior edge with a moderate projection in middle, posterior edge moderately straight; cilia fuscous-whitish. Hindwings with termen rounded; colour and cilia as in forewings; without markings: a few golden-ochreous hairs toward base. Under-side of both wings ochreous-fuscous, dorsum broadly dull-whitish; finely dusted with whitish, especially hindwings; markings of upper-side, except stigma, reproduced; hindwings with dull-purplish reflections and a curved postmedian series of dull-whitish spots from beneath costæ to vein 1 in middle, lying on somewhat darker ground colour; cilia as above.

♀, 30 mm. Head, etc., as in ♂. Forewings as in ♂, but termen more bowed; a white, somewhat quadrate spot between veins 4 and 5 at base, sometimes absent; a transverse row of 3 white subapical spots; cilia as in forewings. Hindwings as in ♂. Under-side of wings as in ♂, markings of upper-side of ♂ reproduced.

Type ♀, in Berlin Museum (Coll. Staudinger); type ♂, in Coll. Lower; types *Bathrophora*, in Coll. Lower.

This species is subject to slight variation, but not of sufficient importance to separate the forms. The *presence* of the subapical spots in the ♂ is comparatively rare, and the *absence* of same in ♀ is very rare; the interneural quadrate spot of ♀ is subject to variation in size, becoming almost obsolete in some specimens, but is generally indicated. I have now twenty-nine specimens taken at Mackay, Kuranda, and Cairns from December to March.

27. H. CRYPSIGRAMMA, M. and L.

Telesto crypsigramma, M. and L., T.R.S., p. 81.
Herberton, Queensland.
Type in Coll. Lower.

28. H. PERRONI, Latr.

Enc. Meth., ix., p. 763, 1823. *Telesto Perronii*, M. and L., T.R.S., p. 75. *Telesto Kochii*, Feld., Verh., Zool., Bot., Geis xii., p. 491, 1862. *Hesperilla doclea*, Hew. Desc., Hesp., p. 39, 1868. ♀, *Telesto arsenia*, Plötz, S.E.Z., xlv., 384, 1884.

As the now accepted rule is that proper names should be in the genitive and terminate in "i" and not "ii," I have adopted *Perroni* in preference to *Perronii*. *Telesto arsenia* is identical with this species; Plötz's coloured drawing, which is before me, depicting both the upper and under side, indicates the ♀ with certainty.

Types ——?

Brisbane to Herberton, Queensland. Forty-nine specimens; between November and February.

29. H. MALINDEVA, n. sp.

♂, 32-35 mm. Head, palpi, thorax, and abdomen dark-fuscous; palpi, thorax, and abdomen beneath ochreous-white; thorax above clothed with short dull-golden hairs. Antennæ dark-fuscous, annulated with white. Legs ochreous-whitish, posterior pair mixed with reddish-ochreous. Forewings elongate, triangular; costa nearly straight, termen gently rounded, oblique; rather dark smoky-brown; markings pale-yellowish: a rather broad transverse spot in end of cell, sometimes much constricted on upper half, a moderate elongate quadrate spot lying on vein 3 at base, a shadowy outline of a larger quadrate spot below; and oblique transverse row of 3 small subapical spots between veins 6 and 9; stigma entire, rather narrow, thickest in middle, from base of vein 4 to vein 1 at about $\frac{2}{3}$ from base; cilia dark-fuscous, terminal half paler. Hindwings with termen rounded; colour and cilia as in forewings, without markings; basal $\frac{2}{3}$ of wing clothed with dull-orange hairs. Under-side of wings dull-ochreous, faintly reddish-tinged, more pronounced on hindwings; markings of upper side of forewings, except stigma, reproduced; lower half of forewings darker than rest of wing; quadrate spot below vein 3 tolerably well developed; dorsum whitish-ochreous throughout; a suffused quadrate patch, below the quadrate spot; hindwings with 2 small roundish fuscous spots between veins 2 and 4 at $\frac{2}{3}$ from base; cilia as above, becoming grey-whitish on tornus of hindwings.

♀, 42 mm. Head, etc., as in ♂. Wings as in ♂, but termen of forewings more rounded; spots larger, an additional moderately large quadrate spot lying between veins 2 and 3 at $\frac{2}{3}$ from base, immediately below postcellular spot; a roundish whitish spot lying on vein 1 at $\frac{2}{3}$ from base. Under-side as in ♂.

Allied to *Perroni*, Latr., but abundantly distinct by shape of stigma, cellular spot, and under-side of hindwings.

I have dedicated this species to my wife (Eva Linda May), whose keen interest in the *Hesperiadæ* is of valued assistance to me.

Type ♂, Coll. Lower; type ♀, in Coll. Waterhouse.

Herberton, Queensland. Two ♂ specimens and one ♀, the latter in Coll. G. A. Waterhouse; taken by Mr. Dodd in January.

30. H. XIPHIPHORA, n. sp.

♂, 28 mm. Head, palpi, antennæ, and thorax dark-fuscous; palpi and thorax beneath pale-yellow; antennæ beneath spotted with yellowish, apiculus red. Legs and abdomen yellowish-fuscous, abdominal segments yellow. Forewings rather short, costa straight, termen oblique, nearly straight; fuscous ochreous; basal half of wing clothed with short dense orange hairs; markings dull-whitish; a somewhat sickle-shaped elongate spot in posterior end of cell; a small quadrate spot at base of veins 3 and 4, another slightly larger immediately below; a transverse series of 3 subapical spots, median smallest; stigma black, very broad, erect, entire, from just below vein 1 at ⅔ from base to base of veins 3 and 4; cilia fuscous, base darker, mixed with whitish or terminal half. Hindwings with termen rounded; colour and cilia as in forewings, base and dorsum clothed with rather long orange hairs; two moderate, well-marked, yellow-whitish ovoid spots, separated by intervening veins just beyond middle of wing at ⅔ from base.

♀, 30 mm. Head, palpi, antennæ, thorax, abdomen, and legs as in ♂. Forewings with colour and markings as in ♂, but cellular spot irregularly 8-shaped and other spots similar but much enlarged, spot at base of veins 2 and 3 quadrate; a whitish quadrate spot lying on vein 1 in middle. Hindwings as in ♂, but lower spot much smaller and often obscure; cilia of both wings as in ♂.

Under-side of all wings of both sexes thickly clothed throughout with orange scales, excepting dorsum of forewings and a patch above anal angle; markings of upper-side, except stigma, reproduced, and more or less edged with fuscous; cilia more yellowish than above.

Types in Coll. Lower.

This insect is very closely allied to *croceus*, Misk., being intermediate between that species and the following. It differs from *croceus* primarily by the very broad stigma (of which I have not met with intermediate forms), the shorter and more abrupt wings and general contour. The female *croceus* has the spot which lies at the base of veins 2 and 3

cartridge-shaped, with its apex directed inwards, and its *outer* edge does not reach more than beyond the middle of the spot above; whereas in the present species it is quadrate and reaches to the extreme edge. These characters are constant enough to warrant the assumption that it is a good species and not a variety of *croceus* or *xanthomera*.

Port Darwin. Fourteen specimens; in February, March, and April. Cairns, Queensland. One specimen; in December (F. P Dodd).

31. H. CROCEUS, Misk.

♂, *Hesperilla croceus*, Misk., P.R.S., Qld., 1889, p. 150. ♀, *l.c.* (*nec croceus*). ♀, *Hesperilla satulla*, Mab., Comp. Rend., Ent. Belg., vol. xxxv., p. 82, 1891. *Telesto croceus*, M. and L., T.R.S., p. 79.

I sent a ♀ specimen to Mabille, who returned it as *H. satulla*, Mab. (?), at the same time stating that the type was now in Coll. Dr. Staudinger (since purchased by the Berlin Museum). Herr Flanderky has sent me an excellent coloured figure of the type *satulla*, which agrees exactly with ♀ *croceus*, Misk. *Croceus* is subject to some variation, especially in the hindwings of ♀, the upper-side of which sometimes has the two conspicuous median spots, and sometimes one only, and in rarer cases practically absent, yet, strange to say, the *two* are always present on the *under-side*, though sometimes obscurely delineated.

Type ♂ *croceus*, Misk., in Brisbane Museum; type ♀, in Coll. Lower; type *satulla*, Mab., in Coll. Staudinger (Berlin Museum).

Port Darwin; Brisbane, Cooktown to Cairns, Queensland; February, March, and April.

32. H. SENTA, Misk.

♀, *Hesperilla senta*, Misk., Ann. Qld. Mus. Supp., 1891. *Telesto senta*, M. and L., T.R.S., p. 78.

Having received better specimens from Mr. Dodd, taken at Kuranda, I find that the ♂ insect requires redescribing.

♂, 28 mm. Head, palpi, antennæ, and thorax dark-fuscous; palpi and thorax yellowish beneath; antennæ spotted beneath with whitish, apiculus reddish; abdomen dark-fuscous, beneath yellow; segmental margins yellowish. Legs fuscous, yellowish tinged. Forewings elongate, triangular; costa faintly sinuate in middle, termen hardly rounded, oblique; dark-golden fuscous, thickly clothed on basal half with short orange hairs; markings semi-transparent, pale-yellowish; an irregular quadrate spot in posterior end of cell, strongly indented anteriorly, lower edge somewhat elongate; an ovoid spot, sometimes obscure, imme-

diately below; stigma narrow, entire, slightly oblique, from immediately above dorsum to base of veins 4 and 5; a somewhat cartridge-shaped spot touching its apex; a small spot immediately below; an oblique transverse row of 3 subapical spots, median smallest; cilia pale-whitish yellow, distinctly barred with dark-fuscous. Hindwings with termen rounded; colour and cilia as in forewings; a moderate deep-yellow ovate spot at $\frac{2}{3}$ from base, between veins 6 and 7; a similar spot at $\frac{2}{3}$ from base between veins 3 and 4. Under side of forewings dark-fuscous; costal area and upper half of termen broadly yellow; markings of upper side, except stigma, reproduced in golden-ochreous. Hindwings wholly yellow except a broad cuneiform blackish patch along dorsum; markings pale-yellowish, edged with fuscous; an obscure spot at base of veins 7 and 8; a second larger, in end of cell; a third between veins 7 and 8 at $\frac{2}{3}$ from base; a fourth, largest, ovate just below; 2 very small dots just below, and 3 moderately large spots between last 2 and vein 1, the last 7 forming a curved series parallel to termen.

Type ♀, in Coll. Queensland Museum; type ♂, in Coll. Lower.

Cooktown, Kuranda, and Herberton, Queensland; November to February.

33. H. XANTHOMERA, M. and L.

Telesto xanthomera, M. and L., T.R.S., p. 80.

Types in Coll. Lower.

Brisbane and Cairns, Queensland.

The localities, Victoria and New South Wales, previously given are probably erroneous.

34. H. CHAOSTOLA, Meyr.

Telesto chaostola, Meyr, P.L.S., N.S.W, 1887, p. 830; M. and L., T.R.S., p. 65.

Type ♂, Coll. Meyrick; type ♀, in Coll. Lower.

Blackheath, New South Wales; Huonville, Tasmania, in November and December.

The upper-side of the ♀ of this species bears a rather striking appearance to *Trapezites croites*, Hew., but the underside is quite different. This and the following species appear to be allied, and have the terminal joint of palpi very long compared with other species of the genus.

35. H. ATRALBA, Tepp.

T.R.S., S.A., iv., 1881, p. 33, pl. ii., fig. 5. *Telesto atralba*, M. and L., T.R.S., p. 71. *T. dactyliota*, Meyr., P.L.S., N.S.W., 1887, p. 831.

Type *atralba*, in Adelaide Museum; type *dactyliota*, in Coll. Meyrick.

Port Lincoln and Moonta, South Australia; Geraldton, Western Australia; in October and November.

36. H. DRACHMOPHORA, Meyr.

Telesto drachmophora, Meyr., Ent. Mon. Mag., p. 82, 1885; M. and L., T.R.S., p. 61.

Type in Coll. Meyrick.

This and the two following species have terminal joint of palpi long and somewhat slender.

Deloraine, Tasmania; Moonbar, New South Wales; in March.

37. H. DOMINULA, Plötz.

Telesto dominula, Plötz, S.E.Z., xlv., p. 379, 1884; M. and L., T.R.S., p. 61.

Type ——?

I much doubt if this species can remain as distinct from *drachmophora*, Meyr. I have a specimen from Newcastle, New South Wales, which agrees very well with Plötz's description and figure. It chiefly differs by the markings of underside of hindwings being dull-whitish instead of being silvery-white, as in *drachmophora*, but as both species are scarce and material scanty I prefer to keep them separate for the present.

Tasmania; Newcastle, New South Wales.

38. H. MONTICOLÆ, Oll.

P.L.S., N.S.W., 1889, p. 624; M. and L., T.R.S., p. 62; Waterh., Vict., Nat., 1903, p. 52.

Having received more perfect specimens from Mr. Edmund Jarvis, I redescribe this species, the former description being faulty. ♂, 22-25 mm. Head, thorax, palpi, and abdomen dark-fuscous, beneath yellowish terminal joint palpi long. Antennæ fuscous, annulated with whitish-yellow. Legs yellowish. Forewings elongate, moderate, triangular, termen gently rounded oblique; dark-fuscous, basal half clothed with short orange hairs; a small somewhat quadrate orange spot in end of cell; a somewhat cuneiform orange spot at base of veins 3 and 4, its apex directed inwards; a small ovoid orange spot immediately below, sometimes absent; a transverse row of 3 pale-yellow subapical spots; stigma dull-black, more or less broken into spots, oblique, from vein 1 to base of orange cuneiform spot; cilia, dull-reddish orange, barred with blackish at extremities of veins. Hindwings with termen somewhat strongly bowed; colour and cilia as in forewings; basal area clothed with fine long orange hairs; an indistinct

orange spot at end of cell, sometimes very suffused, beyond which an orange suffusion; two small, well-marked elongate orange spots beyond extremity of cell, separated by vein; under-side of forewings with markings, except stigma, of upper-side reproduced, the 3 subapical spots pale-lemon, cellular spot edged on either side with black; costal and cellular area of wing deep-orange from base to subapical spots; an irregular lemon-coloured apical patch extending to middle of termen; rest of wing blackish; dorsum dusted with ochreous. Hindwings beneath ochreous-fuscous, with lemon-coloured markings; an irregular cuneiform spot lying at base of wing; an irregular fascia from beneath costa at ⅓ to middle of dorsum, where it becomes confluent with a large spot on anal angle and a smaller one near base; the two spots of upper side connect the fascia beyond middle; between basal cuneiform spot and upper edge of fascia is a small dot; an irregular quadrate spot on termen in middle, nearly touching lower edge of fascia; two small dots above termen, between veins 2 and 4; cilia of both wings with a broad lemon-coloured basal line.

♀. 25 mm. Head, palpi, antennæ, and thorax as in ♂. Upper side of forewings somewhat lighter than ♂, and spots larger and the discal series consisting of four spots; first and second elongate, third smaller, lowest larger cuneiform; cilia yellowish, spotted with fuscous. Hindwings with colour and cilia as in forewing; a large cartridge-shaped yellow spot just beyond end of cell, below which are two smaller but similar spots, divided by intersecting vein. Under-side of both wings as in ♂, markings of upper-side darker, except subapical series of spots.

Type ♂, in Australian Museum; type ♀, in Coll. Lyell, Moonbar, near Mount Kosciusko, New South Wales, in March; near Walhalla, Victoria (E. Jarvis), in February.

39. H. CRYPSARGYRA, Meyr.

Telesto crypsargyra, Meyr., P.L.S., N.S.W., p. 829, 1887; M. and L., T.R.S., p. 58.

Type in Coll. Meyrick.

Blackheath and Katoomba, New South Wales; November to February.

40. H. PICTA, Leach.

Zool., Misc., i., p. 126, pl. lv., figs. 4-5, 1815; Math., T.E.S., 1888, p. 185, pl. vi., figs. 9-9*a*; Vict., Butt., ii., 1894, p. 121; M. and L., T.R.S., p. 57.

Types ——?

In the former Revision the references to the figures of *picta* and *ornata* were inadvertently given as the same.

Sydney and Bathurst, New South Wales: Victoria; from October to January.

Mr. R. Illidge has specimens taken at Brisbane.

41. H. MASTERSI, Waterh.

P.L.S., N.S.W., 1900, pl. i., figs. 5-8, p. 54; M. and L, T.R.S., p. 55.

Types in Coll. Waterhouse.

Blue Mountains, Illawarra, New South Wales: in January.

42. H. ORNATA, Leach.

Zool., Misc., i., p. 126, pl. lv., figs. 1-3, 1815; Math., T.E.S., 1888, p. 187; Aust., Butt, 1889, p 41; *Telesto ornata*, M. and L., T.R.S., p. 53.

Type ——?

Wandin, Victoria; Sydney, New South Wales, to Cooktown, Queensland; from October to January.

43. H. ORNATA, Leach, *var.* MONOTHERMA, Low.

T.R.S., S.A., 1907, p. 169.

In the original description this name was misprinted *monotherm*. Some years ago, in looking through the *Hesperiadæ* in the Queensland Museum, I saw a ♀ variety of *ornata* in poor condition with all spots of upper-side of forewing (excepting the 3 subapical and a minute one below) absent. The under-side was as usual, but without the curious dark spot in the white patch of hindwings. This specimen is an intermediate link between *monotherma* and *ornata*. In the former all markings of upper side of forewings are obsolete.

Type in Coll. Lower.

Cooktown and Herberton, Queensland.

44. H. PERORNATA, Kirby.

Ann. Mag., N.H., 1893, p. 437. ♀, *Telesto perornata*, M. and L., T.R.S., p. 2.

This species and *munionga*, Oll., will probably require a new genus to receive them. The stages of the larvæ and pupæ are quite different from *ornata* and its allies. This species shows considerable resemblance to *ornata*, but is immediately separable by the absence of stigma of ♂. The club of antennæ is slightly different from *ornata*, being somewhat more robust and more evenly curved. Superficially it shows such similarity as to be almost confused with that species, especially the ♀, hence my reason for retaining it in *Hesperilla*. The absence of stigma of ♂ in this and the following I at present regard as specific only. This I consider the better plan than erecting

a new genus, which may ultimately prove to be superfluous.

The ♂ does not differ from the ♀ excepting in size (26-28 mm.).

Type ♀, in British Museum.

Victoria; Blue Mountains, New South Wales; in October and November.

45. H. MUNIONGA, Oll.

P.L.S., N.S.W., 1889, p. 623; *Telesto munionga;* M. and L., T.R.S., p. 56.

This species presents the same peculiarities as *perornata*. They are both mountain species.

The sexes do not differ.

Types in Coll. Australian Museum, Sydney.

Mount Kosciusko, New South Wales.

8. TRAPEZITES, Hb.

Verz. Bek. Schmett, p. 112, 1816; *Patlasingha*, Watson, P.Z.S., p. 74, 1893.

Club of antennæ elongate, more or less bent, apiculus pointed, long or moderately long. Palpi obliquely ascending or subporrect, terminal joint short, subconical. Posterior tibiæ with all spurs. Forewings in ♂ without stigma; vein 5 parallel to 4 and 6, slightly nearer 6 at base. Hindwings with vein 5 obsolete.

Type *symmomus*, Hb., *Trapezites*.

Type *phigalia*, Hew., *Patlasingha*.

Watson separated his genus *Patlasingha* from *Trapezites* on the length of the terminal joint of palpi and length of apiculus of antennæ. I have altered the generic characters of *Trapezites* so as to embrace both genera, as they are too intimately associated to warrant division.

46. T. HETEROMACULA, M. and L.

T.R.S., p. 84.

The ♀ of this species does not differ from male except that the two small spots on under-side of hindwing, near termen, are somewhat larger and less rounded.

Note.—In the original tabulation the name is misprinted *heliomacula*.

Type ♂, in Coll. Macleay Museum.

Cairns, Herberton, and Endeavour River, Queensland; in May.

47. T. PETALIA, Hew.

Hesperia petalia, Hew., Desc. Hesp., p. 32, n. 25, 1868; Herr.-Sch., S.E.Z., 1869, p. 80, pl. iii., fig. 11; M. and L., T.R.S., p. 85; *Telesto megalopis*, Meyr., P.L.S., N.S.W., 1887, p. 832.

Type *petalia*, in Coll. Hewitson (British Museum); type *megalopis*, in Coll. Meyrick.

Sydney to Mackay; from March to November.

48. T. LUTEA, Tepp.

Hesperilla lutea, Tepp., T.R.S., S.A., iv., p. 33, t. 2, fig. 6, 1887; *Trapezites petalia*, Misk. (*nec* Hew.), Ann. Qld. Mus., p. 79, 1891 (in part); *T. lutea*, M. and L., T.R.S., p. 90.

Type in Adelaide Museum.

This species has the apiculus of antennæ shorter than the other species of the genus.

Stonyfell and Port Lincoln, South Australia; Hobart, Tasmania; and New South Wales; in November.

49. T. IACCHUS, Fabr.

Papilio iacchus, Fabr., Ent. Syst., p. 533, 1775; Donovan, Ins. New Holl., pl. xxxi., fig. 1, 1805.

The description formerly given by us, *T. iacchus*, Fabr., refers to *eliena*, Hew. The whole trouble arose thus: Herrich-Schäffer recognized that Hewitson's *eliena* was allied to *iacchus*, but not knowing true *iacchus* says (S.E.Z., p. 80, n. 66, 1869):—"Ich bestimmte dies Thier vor Herrn Hewitson's Erklärung als *H. iacchus*, Don., Austral; es sind in diesem Bilde die Flecke der V fl nur gar zu licht und jene der U.S. der H fl zu gross weiss gekernt," indicating that he disagreed with Donovan's as representing *iacchus*. Plötz no doubt considered Herrich-Schäffer's figure of *eliena* and Donovan's were not the same, and imagined that Herrich-Schäffer's incorrectly determined Hewitson's *eliena*, and so considered the figure to represent *donnysa*, Hew., and placed *eliena*, Hew., as a synonym of *iacchus*. The original Fabrician description reads:—"*Papilio iachus; alis ecaudatis, flavo maculatis postis punctus sex niveis*" (wings without tails, spotted with yellow and six snowy-white dots). The number of spots should be five, not six, although Donovan's figure shows seven, caused by the veins dividing two of the spots. Mr. R. E. Turner states that the type *iacchus* which is in the Banksian Collection has the spots somewhat more elongate than usual, and although neither *iacchus* nor *eliena* can be said to possess white spots on forewings, those on *iacchus* are yellowish-white and those of *eliena* golden-yellow. I am quite satisfied that the northern form, ranging from Brisbane to Cape York, is *iacchus;* and the southern form, ranging through New South Wales, Victoria, South Australia, and Tasmania, is *eliena*, Hew. Professor Mabille, to whom specimens were submitted, returned them as *phigalia*, Hew.; certainly an error in identification.

♂ ♀, 34-40 mm. Head, palpi, antennæ, thorax, and abdomen dark-fuscous, palpi and thorax beneath whitish, antennæ spotted beneath with ochreous-whitish, apiculus reddish. Legs reddish-fuscous. Forewings elongate, triangular, moderate; costa nearly straight, termen gently rounded, oblique: rather light-golden fuscous, with yellowish-white markings; basal third of wing clothed with yellow hairs; a rather large quadrate spot in posterior end of cell, slightly indented anteriorly and posteriorly; a moderately large cartridge-shaped spot at base of veins 3 and 4, and a larger one, more quadrate, immediately below; a suffused roundish spot lying on vein 1 about middle: a transverse row of three cartridge-shaped subapical spots; a streak of yellow along dorsum to middle, and a similar streak along vein 1 to middle, meeting spot: cilia fuscous, yellowish-white round anal angle. Hindwings with termen rounded; colour as in forewings; base and dorsum clothed with long yellowish hairs; an orange median band divided into three parts by intersecting veins; upper part elongate-ovate, with a short projection toward termen; median very small; cuneiform; lower somewhat similar to last, but larger; lower edge mixed with orange hairs; cilia yellow, becoming fuscous at base. Under-side of forewings dull-reddish ochreous; markings of upper-side reproduced; basal half of costa and upper half of cell yellow; basal half of wing and lower half of termen dark-fuscous, inclining to black; cilia paler than above. Hindwings rather bright-reddish ochreous; markings distinct, snow-white, narrowly edged with fuscous; a spot in cell toward base; a second at $\frac{2}{3}$ from base between veins 6 and 7, and three others at $\frac{2}{3}$ from base in a curved series between veins 1 and 4; cilia pale-ochreous fuscous.

Brisbane to Cape York. Eleven specimens; from February to May.

50. T. ELIENA, Hew.

Desc. Hesp., p. 32, n. 24, 1868; Herr.-Sch., S.E.Z., n. 66, pl. iii., fig. 13, 1869; *iacchus*, Semp. (*nec* Fabr.), Mus. God. Lep., xiv., p. 49, 1878; *Telesto cæcilius*, Plötz, S.E.Z., p. 380, xlv., 1884; *eliena*, Misk. (in part), Ann. Qld. Mus., p. 78, 1891; *iacchus*, M. and L. (*nec* Fabr.), T.R.S., p. 87.

Note.—Miskin's *iacchus* is partly *symmomus*, Hb., and *maheta*, ♂, Hew. The true *iacchus* was apparently unknown to him.

♂ ♀, 34-38 mm. Head, palpi, thorax, and abdomen dark-fuscous, clothed with pale-greenish-yellow hairs, beneath pale-yellowish; antennæ fuscous, annulated with ochreous, posterior half beneath ochreous, terminal half of apiculus beneath reddish. Legs dull-orange. Forewings elongate, triangular, costa gently arched, termen bowed, oblique;

varying from golden-fuscous to dark-fuscous; costal and basal areas clothed with orange scales; markings golden-orange, placed as in *iacchus;* spot on vein 1 bright orange, and more or less anteriorly suffusedly mixed with golden hair scales and continued to base: a bright orange streak on dorsum from base to middle: cilia orange, basal half dark-fuscous Hindwings dark-fuscous; basal and dorsal hairs long, orange; median band orange, shaped as in *iacchus*, but broader: cilia orange, with blackish bars at neural extremities Under-side of both wings bright orange-fulvous, lower $\frac{2}{3}$ of forewings dark-fuscous, markings of upper-side reproduced, but paler; cilia as above. Hindwings with 5 spots placed as in *iacchus*, that in the cell being the largest, white, ringed with black; the 4 remaining spots are *much smaller*, and are sometimes wholly blackish without the white centres, all spots larger in ♀.

Type in Coll. Hewitson, British Museum.

Plötz places *eliena*, Herr.-Sch., as a synonym of *donnysa*, Hew. (S.E.Z., t. 3, f. 13, 1869), and *eliena*, Hew., as a synonym of *iacchus*, Fabr.

Macedon, Gisborne, etc., Victoria; Como, Sydney, etc., New South Wales; Brisbane to Mackay, Queensland; Deloraine, Tasmania; Mount Gambier, South Australia. Twenty-two specimens; October to January.

Plötz's locality for *iacchus*, *i.e.*, India, is an error.

51. T. ELIENA, Hew., *var.* MONOCYCLA, *nov. var.*

T. iacchus, A. and S. (*nec* Fabr.), Vict., Butt., p. 115.

♂ ♀, 34-44 mm. Head, thorax, etc., as in *eliena*. Forewings somewhat more elongate than in *eliena*, markings placed as in *eliena*, but deeper coloured. Hindwings as in *eliena*, but median band deeper orange and hardly separated by veins. Under-side of both wings as in *eliena*, but all markings of hindwings absent except the large cellular spot. This is such a well-marked variety that it can be conveniently separated. It is at once recognized by the single cellular spot on hindwings beneath.

Mount Gambier, South Australia (November); Gisborne and Berwick, Victoria (December). Four specimens.

52. T. SYMMOMUS, Hb.

Zutr., ex. Schmett. figs. 225, 226, 1823; Math., T.E.S., 1888, p. 183; Staud., ex. Schmett, pl. c., 1888; Vict., Butt., pt. ii., p. 114, 1894; M. and L., T.R.S., p. 86; *Telesto praxedes*, M. and L. (*nec* Plötz), T.R.S., p. 86.

Type ——?

We formerly quoted *Telesto praxedes*, Plötz, as a synonym of this species, but are now satisfied that *praxedes* is identical

with ♂ *T. maheta*, an opinion also shared by Colonel Swinhoe.

Victoria, New South Wales, and Brisbane to Herberton, Queensland; from November to March.

53. T. MAHETA, Hew.

Hesperia maheta, Hew., Ann. Mag., N.H., 1877, p. 80. *Trapezites maheta*, M. and L., T.R.S., p. 89, Waterh., Vict., Nat., 1903, p. 54. *Telesto praxedes*, Plötz, S.E.Z., p. 378. ♂, *Trapezites iacchus*, Misk. (*nec* Hew.), Ann. Qld. Mus., p. 78, 1891.

Mr. Waterhouse makes *phlœa*, Plötz, a synonym of the ♀ of this species, but this conclusion is undoubtedly an error, that species being identical with *phigalia*, Hew. In our former description we mentioned that the under-side of hindwings has 7 silvery-white spots; this is the rarer form, the usual number being 4, the remaining number being, as a rule, inconspicuous.

Type in Coll. Hewitson, British Museum.

Como, etc., New South Wales; Brisbane to Cairns, Queensland. Nineteen specimens; December to April.

54. T. MAHETA, Hew., *var.* PHIGALIOIDES, Waterh.

Vict., Nat., 1903, p. 56.

This is a very curious and remarkable variety, agreeing essentially on upper side with typical *maheta*, with the exception of the third subapical spot of forewing being irregularly placed and the broader and deeper coloured fascia of hindwings. The under-side is greyish, the spots of upper-side reproduced, slightly larger, and the spots of hindwings as small brown rings *never centred with silver*.

Types in Coll. Lyell.

Gisborne, Toora, etc., Victoria.

55. T. MAHETA, Hew., *var.* IACCHOIDES, Waterh.

Vict., Nat., 1903, p. 56.

This chiefly differs from typical *maheta* by the salmon-coloured under side and silver spots of hindwing (using six in number) being of moderate size, that of the apex being of equal size to that of anal angle.

Type in Coll. Waterhouse.

Como and Blue Mountains, New South Wales.

56. T. PHIGALIA, Hew.

Hesperia phigalia, Hew., Desc. Hesp., p. 32, n. 23, 1868; Herr.-Sch., S.E.Z., t. 3, fig. 15, 1869. *Telesto phlœa*, Plötz, S.E.Z., xlv., p. 378, 1884. *Trapezites phillyra*, Misk., P.R.S., Qld., p. 153, 1889. *T. phigalia*, M. and L., T.R.S., p. 94.

Mr. Waterhouse (Vict. Nat., 1903, p. 55), when writing, considered that *phlæa* (Plötz) was not identical with the above species. Plotz's drawing admits of no doubt, an opinion in which Mr. Waterhouse acquiesces.

Type *phigalia*, in Coll. Hewitson (British Museum); type *phillyra*, in Coll. Queensland Museum.

South Australia, Victoria, and New South Wales; from September to March.

9. ANISYNTA, n.g.

Club of antennæ moderately robust, apiculus blunt. Palpi subporrect, hairy or densely hairy beneath; terminal joint, short or moderate, subconical, posterior tibiæ with all spurs. Forewings with costa moderately straight, slightly concave in *Tasmanicus* and *argenteo-ornatus*; ♂ without stigma; 5 parallel to 4 and 6, slightly nearer 6 at base. Hindwings with vein 5 obsolete.

I have formed this genus to receive those species with the blunt apiculus of antennæ; it bears the same relation to *Trapezites* as *Motasingha* does to *Hesperilla*.

Type *cynone*, Hew.

57. A. CROITES, Hew.

Cyclopides croites, Hew., ex. Butt., v., fig. 14, 1874. *Astictopterus croites*, Hew., Misk., Ann. Qld. Mus., p. 78, 1891. *Trapezites croites*, M. and L., T.R.S., p. 88.

Type in Coll. Hewitson (British Museum).

So far to my knowledge the type is unique. As previously mentioned, the drawing which I possess, taken from the type, bears a striking resemblance on the *upper-side* to the ♀ *Hesperilla chaostola*, Meyr.

Western Australia.

58. A. ARGENTEO-ORNATUS, Hew.

Cyclopides argenteo-ornatus, Hew., Desc. Hesp., p. 41, 1868; ex. Butt., v., figs. 18-19, 1874. *Trapezites argenteo-ornatus*, M. and L., T.R.S., p. 91.

Type in Coll. Hewitson (British Museum).

South-West Australia (Perth): in October and November.

59. A. TASMANICUS, Misk.

Hesperilla Tasmanicus, Misk., P.R.S., Qld., 1889, p. 149. *Telesto comma*, Kirby, Ann. Mag., N.H., 1893, p. 436. *Trapezites Tasmanicus*, M. and L., T.R.S., p. 96.

Type *Tasmanicus*, in Queensland Museum; type *comma*, in British Museum.

The costa of this species is faintly sinuate beyond middle.

Tasmania and Victoria: November to January.

60. A. POLYSEMA, Low.

Hesperilla polysema, Low., T.R.S., p. 311, 1908.

The ♂ of this species is without a stigma, consequently I refer it to *Anisynta*. This sex differs very little from the ♀, excepting that it is slightly smaller (34 mm.), and the small additional fleck above vein 1 on under-side is also conspicuous on upper-side; there are very faint indications of two or three whitish flecks on upper side of hindwing (in one specimen tolerably distinct). The row of spots on under side of hindwings are somewhat smaller, and the fifth one, counting from the bottom, has a tendency to be geminate. In all probability these characteristics will be *en evidence* in better and fresher specimens of the ♀. The type from which the original was taken was somewhat imperfect. The species under review does not approach any other known to me, but appears nearest *Tasmanicus*, Misk.

Type ♀, in Coll. Lyell; type ♂, in Coll. Lower.

Port Darwin; and Chillagoe, North Queensland. Two specimens; in February (F. P. Dodd).

61. A. (?) ARGINA, Plötz.

The reference given to this species is S.E.Z., xliv., p. 227, n. 903 (1883). *Hesperia argeus*, Plötz (Weymer M.S.S.) is on that page, and the number is 704, and as the insects are so widely divergent the reference is probably wrong. I have no copy of S.E.Z. of that date, so am unable to state definitely. Mr. Waterhouse gives "Mittheilungen Verein für neu Vompommern und Rugen in Greifswald (Berlin), p. 22, 1884," as the reference. The description of *argina* is as follows:—"Fichlerkolbe (? Fühlerkolbe) am Ende stumpf abgerundet. Oberseite schwarzbraun. V fl nur mit den typischen weissen Flecken; der in der Mittel 3 ist gespalten, der in Z. 1 ist getheilt und grau; in Z. 5 ein Querstrich. H. fl mit 5 grauen Puncten im Bogen hinter der Mitte. Unterseite grau mit braunen Rippen. Vdfl mit den weissen Flecken wie oben, auf der Hinterhälfte braun. H. fl. mit 8 weissen Puncten in $\frac{3}{4}$ Kreis und einem in der Mitte."

Herr.-Sch., I.L. 13 mm., Brisbane.

It is referred to the genus *Syrichthus*, Bdv. The description, so far as it goes, agrees somewhat with *polysema*, Low., but the absence of the curved series of 5 *grey dots* on upper-side of hindwing is a deterrent character. One of my male specimens of *polysema* has a faint curved series of 5 *dull whitish* dots beyond middle on upper-side of hindwing.

The drawing of *argina* before me shows the 5 grey dots, also the divided grey dot in cell 1. And the under-side

of both wings has the spots situated similar to those in *polysema*, but the costal, apical, and terminal areas of forewings and nearly the whole of hindwings are suffused with *pale-lilac blue*. whereas in *polysema* the ground-colour is yellowish-fuscous, so that probably *argina* represents a species allied to *polysema*, but separable by the above-mentioned differences The locality given is Brisbane, and the expanse (one wing only) is 15 mm. *Polysema* has so far been recorded only from Chillagoe district and Port Darwin.

62. A. CYNONE, Hew.

Cyclopides cynone, Hew., ex. Butt., v., fig. 17, 1874. *Pamphila gracilis*, Tepp., T.R.S., S.A., 1881, p. 34, pl. ii., fig. 7, *Trapezites gracilis*, M. and L., T.R.S., S.A., p. 93.

Type *cynone*, in Coll. Hewitson, British Museum; type *gracilis*, in Adelaide Museum.

Semaphore and Henley Beach, South Australia; Gunbower, Victoria; in June and December.

63. A. SPHENOSEMA, M. and L.

T.R.S., p. 92; *T. paraphaes*, *ib.*, *l.c.*, p. 93.

Types in Coll. Lower.

Further investigation convinces me that *paraphaës* is only a variety of *sphenosema*.

Perth, Western Australia; in November.

10. EXOMETÆCA, Meyr.

P.L.S., N.S.W , p. 833, 1887; M. and L., T.R.S., p. 97.

Type *nycteris*, Meyr.

Club of antennæ elongate, pointed, bent. Palpi subporrect, terminal joint moderately long, pointed. Posterior tibiæ with all spurs. Forewings in ♂ without stigma; 5 parallel to 4 and 6, slightly nearer 6 at base. Hindwings with *5 present*, somewhat nearer to 6 at base.

Contains only the single species.

64. E. NYCTERIS, Meyr.

P.L.S., N.S.W., ser. ii., p. 833, 1887; M. and L., T.R.S., p. 97.

Type in Coll. Meyrick.

Albany, Western Australia; in December

11. TARACTROCERA, Butl.

Cat. Lep., Fabr., p. 279, 1869; Watson, P.Z.S., p. 93, 1893, pl. iii., fig. 20.

Type *mævius*, Fabr.

Antennæ short, club forming a flattened disk, conspicuously hollowed, tip abruptly pointed; palpi ascending, ter-

minal joint moderately long, slender, erect, pointed; posterior tibiæ with all spurs. Forewings with vein 12 reaching costa well before end of cell; vein 5 close to bottom of cell; vein 3 well before end of cell, about twice as far from 2 as from 4; vein 2 slightly nearer to end of cell than base of wing. Hindwings with vein 7 very close to end of cell; 5 absent; 3 immediately before end of cell; vein 2 twice as far from base of wing as from end of cell. Forewing without stigma.

This genus ranges from India, through the Indo-Malayan Archipelago to Australia, and it is probable that other species will be discovered in the tropical parts of Australia. The antennal club is characteristic of this and the following genus.

65. T. DOLON, Plötz.

Apaustus dolon, Plötz, Stett, Ent. Zeit, xliv., p. 165.

♂ ♀, 20-22 mm. Head, palpi, antennæ, thorax, and abdomen fuscous; palpi, thorax, and abdomen beneath whitish. Antennæ annulated with white. Club somewhat flattened, distinctly hollowed, apiculus extremely short. Legs fuscous, posterior pair whitish. Forewings elongate, moderate, costa straight, termen somewhat bowed, oblique, some obscure raised scales on veins 1, 2, and 3 representing stigma, fuscous with yellowish-orange markings. An elongate spot, filling up whole of cell from base to posterior end of cell, with a slight fuscous suffusion toward base, more pronounced in ♂; extreme costal edge fuscous; an oblique transverse fascia, moderately narrow, composed of 8 more or less connected spots, from just beneath costa, at $\frac{2}{5}$ to vein 1 above anal angle; the two spots between veins 4 and 6 are *completely* separated from the remainder, and are very close to the termen; the three subcostal spots (representing the usual subapical series) *are not* placed obliquely, but directly transverse; a narrow streak between vein 1 and dorsum; cilia dark-fuscous, becoming whitish on terminal half and paler at anal angle. Hindwings with termen rounded; colour as in forewings; an orange-yellow spot in posterior extremity of cell; an orange-yellow rather narrow postmedian band of four spots separated only by intervening nervules, extending from vein 1 to 6; the two middle spots much smaller than others, somewhat cartridge-shaped; other two irregularly quadrate; generally an additional spot on vein 7; basal and dorsal hairs orange-yellow; cilia whitish, basal half fuscous, becoming yellowish round anal angle. Under-side of forewings dark-fuscous, markings of upper-side reproduced, basal half of cell fuscous, wing between vein 4, costa, and apex dusted with

yellowish, orange in ♀; cilia whitish-yellow, with a fuscous median line. Hindwings pale-yellowish, in ♀ orange or orange-yellow; markings of upper-side reproduced; an obscure fuscous streak above dorsum, becoming blackish and more clearly developed on termen, where it becomes patch-like: cilia as in forewings.

This species is very distinct from all others by the absence of any defined stigma; the raised scales on veins 1, 2, and 3 require close scrutiny to reveal them, and are apparently absent in some males, probably through denudation. Plötz's figure is a good one, and represents the species clearly. The species later on described as *hypomeloma* is somewhat like the wing pattern, especially beneath, but the blackish streak along the dorsum of *hypomeloma* is absent in *dolon*. Plötz's drawing does not show the peculiar antennæ of the genus, but I attach no importance to this omission, as the drawing otherwise agrees in detail. The additional spot on vein 7 of hindwings is rarely absent.

Type ——?

Mackay, Kuranda, and Cooktown, Queensland; also Port Darwin; in March and April. Fourteen specimens (R. E. Turner and F. P. Dodd).

12. Bibla, Mab.

Wyst., Gen. Inst., xvii., 1904.

Type *Papyria*, Bdv.

This genus differs from *Taractrocera* only by the presence of stigma in ♂.

66. B. papyria, Bdv.

Hesperia papyria, Bdv., Voy., "Astrolabe," Lep., p. 166, 1832. *Taractrocera cœleno*, Cox, Ent., 1872, p. 402. *Hesperilla fumosa*, Guest, T.R.S., S.A., v., p. 37, 1882. *Apaustus alix*, Plötz, S.E.Z., 1884, p. 165. *Ap. minimus*, Misk., P.R.S., Qld., 1889, p. 153. *A papyria*, M. and L., T.R.S., p. 98.

Type *papyria*, Paris Museum; type *fumosa*, Adelaide Museum; type *minimus*, Queensland Museum.

We formerly placed this and the following species in Hübner's genus *Apaustus*, but as that genus, as now accepted, is confined to South America I adopt Mabille's genus as being in keeping with the characters of *Bibla*. The stigma of ♂ is well defined.

Larvæ feed on *Imperata arundinacea* and the imagoes frequent the blossoms of lucerne (*Medicago sativa*).

Herberton, Queensland; January and February. Tasmania, South Australia, New South Wales, and Victoria; from November to March.

67. B. flavovittata, Latr.

Hesperia flavovittata, Latr., Enc. Meth., ix., p. 768, 1823. *Ancyloxypha agraulia*, Hew., Desc. Hesp., p. 45, 1868. *Hesperilla bifasciata*, Misk. (*nec* Tepp.), Ann. Qld. Mus., 1891, p. 81. *Apaustus flavovittata*, M. and L., T.R.S., p. 100.

Type *agraulia*, in Coll. Hewitson (British Museum).

We formerly gave *agraulia*, Hew., as a synonym of *Padraona sunias*, Feld., but a recent comparison of Hewitson's type of *agraulia* with *flavovittata* prove them to be identical. Hewitson says of *agraulia*:—"Alis fuscis; anticis macula magna costali, margine interiori, fascia transversa, maculaque subapiculi vix tripartita aurantiacis, posticis pilis basalibus, macula parva costali, fasciaque transversa aurantiacis." Under-side as above, except that the apex of the anterior wing and the *whole* of the posterior wing are rufous and the bands less distinct. The club and apiculus of this species are very similar to *papyria*; as before mentioned, it is probably a well-marked geographical form of that species.

Perth, Western Australia: in November

68. B. anisomorpha, n. sp.

♂ ♀, 25-28 mm. Head, palpi, thorax, and abdomen orange-yellow; palpi, thorax, and abdomen beneath whitish; palpi tinted with yellow; terminal joint short. Antennæ fuscous, annulated with white, basal half of club white, hollowed, apiculus short Legs yellowish, posterior pair fuscous-tinged. Forewings elongate, triangular, costa straight, termen oblique, hardly rounded, dark-fuscous with orange markings; costal area between base and posterior end of cell and whole of cell orange; slightly oblique transverse row of 8 more or less connected spots from just below costa at $\frac{4}{5}$ to vein 1 at anal angle; the two spots between 4 and 6 are quadrate and *completely* separated from the remainder, and very close to termen; the three subcostal ones are not placed obliquely, but directly transverse; the upper of the lower three of band is narrowly cartridge-shaped; the one below nearly quadrate, and that on vein 1 irregular shaped, excised internally. In the ♂ the 3 subcostal spots are connected with orange costal streak by continuation of same; a somewhat flattened patch of narrow blackish scales (representing stigma) parallel to, and edging inner edge of three lower spots of transverse band, not in ♀; basal half of wing below cell and an elongate dorsal streak orange; cilia fuscous, terminal half yellowish, round anal angle orange. Hindwings with termen rounded; dark-fuscous, basal and dorsal hairs long, orange; an oval orange spot in posterior extremity of cell; a moderately broad submedian orange band, outer edge moderately even, inner edge

with double projection in middle, from vein 1 to vein 6; *not* separated by veins; cilia as in forewings, but more orange round tornus. Under-side of forewings blackish; basal third of cell blackish, apical and terminal area of wings from vein 3 to apex greenish-yellow; markings of upper-side, except stigma, reproduced and very narrowly edged with fuscous; cilia as above, but paler. Hindwings greenish-yellow; a fuscous supra dorsal streak, broadest at termination; cellular spot as above, pale-yellow; submedian band reproduced, but upper portion formed into 3 pale-yellow oval spots, faintly edged with fuscous; an obscure yellow spot on vein 1 (indicating lower spot of band); cilia pale-yellow, mixed with fuscous.

Types in Coll. Lower.

This species is in appearance somewhat like *Taractrocera dolon* (Plötz), but is immediately separated by the presence of stigma in ♂ and broad submedian band of hindwing in both sexes. The transformation of the band of upper-side of hindwings into oval spots on under-side is a peculiar and noteworthy characteristic. The late Dr. Staudinger considered this species *Telicota dara* (Koll.), but the antennæ never agreed (in my estimation) with the characters of *Telicota*, and having recently received the ♂ all doubt is at an end, as *dara has no stigma*, and although the ♀ of the present species is *very similar* to that species, yet the oval spot of orange on vein 8 of hindwings in *dara*, and which appears to be a constant character, is absent in the present species.

Port Darwin, Northern Territory. Two females and one male; in September and May (*Dodd*).

13. Ocybadistes, Heron.

Ann. Mag., N.H. (6), xiv., 1894, p. 105.

Type *Walkeri*, Heron.

Antennæ about ⅗ length of costa of forewings; club moderate, elongate; apiculus bent, rather longer than thickness of club; palpi densely scaled, *terminal joint slender*, erect, about half length of second. Forewings with vein 12 reaching costa well before end of cell; vein 8 to apex; 5 nearer to 4 than to 6; veins 2, 3, and 4 equidistant; vein 2 slightly nearer end of cell than base of wing. Hindwings with termen very slightly excised between 2 and 1*b*; vein 7 well before end of cell; 5 absent; 3 close to end of cell, twice as far from 2 as from 4; vein 2 nearer to end of cell than base of wing. Posterior tibiæ with all spurs present; costa of hindwings above clothed with stiff hairs. *Male with stigma*. This genus has a similar geographical range to *Taractrocera*. It has been suggested that all those species

I have included in this genus should be merged into *Padraona*, Watsn., but the presence of the stigma precludes this, as *mæsa*, Mre., which is the type of *Padraona*, has no stigma. *Padraona* differs from *Ocybadistes* by the absence of the stigma, so that the only two Australian species retained in *Padraona* will be *lascivia*, Rosen., and *heterobathra*, Low.

69. O. MARNAS, Feld.

Pamphila marnas, Feld., Sitz., Akad., Wiss., Wien., Math., Nat., Cl., p. 462, 1860. *Apaustus dschilus*, Plotz, Berl., Ent. Zeit., xxix., p. 229, pl. mccccxciv. (1885). *Telicota marnas*, Elwes and Edwards, P.Z.S., xiv. (4), p. 256, 1897; M. and L., T.R.S., p. 103. *Ocybadistes marnas*, Swinh., T.E.S., pl. ii., fig. 13, p. 21, 1908.

Brisbane to Cooktown, Queensland; from December to June; also from New Guinea and Amboina (type locality).

In Miskin's collection in the Queensland Museum there are 5 specimens of *marnas* and 1 ♀ *augias*, Linn. (var. i.), standing under the name of *olivescens*, Herr.-Sch. I place *marnas* in *Ocybadistes*, chiefly on account of its slender palpi, but it would appear to be more at home in *Telicota* on account of its general resemblance to that genus, but the form of the palpi precludes this.

Type in Coll. Felder.

70. O. WALKERI, Heron.

Ann. Mag., N.H. (6), xiv., 1894, p. 106. *Ancyloxypha agraulia*, Oll., Ann. Mag., N.H., 1888, p. 360, pl. xx., figs. 3*a*, 3*b*. *Apaustus sunias*, M. and L. (*nec* Feld.), T.R.S., p 101.

Type in Coll. British Museum. Taken at Port Darwin, also at Dammar Island.

This species, which is subject to considerable variation, ranges from Adelaide to Port Darwin, being also found in New South Wales, Tasmania, and Brisbane to Cairns. Probably when its geographical range is definitely known it will be found to occur wherever the couch-grass (*Cynodon dactylis*) flourishes, that being one of its chief food plants. The former description (T.R.S., p. 101) being in part defective, and not representing typical forms, I shall redescribe the species, also the southern variety, which is deserving of a distinctive appellation, and which may ultimately be raised to the rank of species. We formerly placed this species in *Apaustus*, but that genus as now restricted is confined to South America. The differences in *Ocybadistes* and *Padraona* (Moore), structurally considered, are to my mind very slender.

♂ ♀, 18-24 mm. Head, palpi, thorax, and abdomen blackish, densely clothed with orange hairs; palpi and thorax beneath whitish, upper half second joint of palpi orange.

Abdomen beneath orange, mixed with white. Legs pale-yellow, posterior pair orange. Forewings elongate, triangular, costa straight, termen oblique, gently bowed in ♂; dark-fuscous, with orange markings; whole of cell and costal area for whole length of cell orange, leaving extreme costal edge dark-fuscous; a moderately broad transverse fascia, from vein 1 to vein 6, very much narrowed between veins 4 and 6 to about half the width of rest of fascia, directed toward termen, but not nearly reaching it; a nearly quadrate subcostal spot (representing the usual subapical spots) lying midway between apex of fascia and end of cell; suffused orange streaks along vein 1 and dorsum; stigma narrow, nearly straight, from vein 1 to 4 running along anterior edge of fascia; cilia dark-fuscous, terminal half orange. Hindwings with termen rounded; basal and dorsal hairs orange; an ovate spot in cell; a moderately broad orange submedian band of orange from vein 1 to vein 6, lower edge irregularly crenulate, upper edge with a slight projection in middle and a small orange spot resting on inner edge of apex of band, often absent; cilia orange-yellow, fuscous at base. Under-side of forewings blackish, base of cell dark-fuscous; apical area and upper half of termen greenish-orange; markings of upper-side, except stigma, reproduced, but paler, and more or less narrowly edged with fuscous; cilia fuscous, orange at anal angle. Hindwings orange, with a greenish tinge; supra-dorsal streak fuscous, more pronounced on termen: markings of upper-side reproduced, but paler, and finely edged with fuscous; cilia orange, mixed with light fuscous.

Tasmania; Sydney, etc., New South Wales; Brisbane to Port Darwin. Forty-seven specimens: from October to May.

71. O. WALKERI, Heron, *var.* HYPOCHLORA, *nov. var.*

The description of this insect is given under the name of *sunias*, Feld., by M. and L. (T.R.S., p. 101), and need not, therefore, be repeated. It differs consistently by the larger size (17-25 mm.), the *much* broader markings, especially in ♂, and especially the clear greenish-yellow under-side of hindwings, which are often without any markings whatever. The stigma is flat and very broad, usually filling up the interspace between the cellular marking and anterior edge of transverse fascia, which, though approached nearest by the Port Darwin specimens, scarcely assumes the same aspect. I have not seen specimens from Victoria, and the specimens I have seen from Sydney, etc., are not satisfactorily connected with the form under review, consequently I prefer to give it a varietal name.

Types in Coll. Lower.

Adelaide, etc., South Australia. Eighteen specimens; from November to February The imagoes frequent the blossoms of Globe amaranth *(Gomphrena)*.

72. O. RECTIVITTA, Mab.

Pamphila rectivitta, Mab., Pet. Nouv., Ent. ii., p. 237, 1878.

♂ ♀, 22-24 mm. Head, antennæ, thorax, and abdomen blackish; antennæ beneath spotted with yellow; club rather narrow, yellow beneath, apiculus fuscous. Thorax and abdomen beneath yellow. Legs yellowish. Forewings elongate, triangular, costa nearly straight, termen oblique, hardly bowed, blackish-fuscous, with orange markings; whole of cell and costal area, from base to end of cell, orange; a small, short, elongate streak lying on lower edge of cell; a direct transverse fascia from vein 1 to vein 6, more or less dentate on either side, but more so posteriorly; an irregular triangular spot, its apex directed toward costa (representing subapical series of spots) lying midway between extreme apical spot of fascia and posterior extremity of orange cellular patch; a streak along vein 1 and another, more distinct, along dorsum; stigma moderate, running along anterior edge of fascia, from vein 1 to near vein 5, more or less broken into spots; cilia dark-fuscous, becoming orange on terminal half round anal angle. Hindwings with termen rounded, slightly more prominent in middle; an oval spot of orange in posterior extremity of cell; an orange submedian band, about twice as broad as fascia of forewings, from vein 1, where it is continued as a streak to base of wing, to vein 6; both edges irregular, lower somewhat scalloped in ♂; a small spot resting on middle of vein 7 and touching apex of band, generally separated in ♀; both fascia of forewings and band of hindwings much abbreviated in ♀; cilia yellowish-orange, with fuscous spots at extremities of nervules. Under-side of forewings black, basal portion of cell dark-fuscous, apical area and upper-half of termen mixed with dull-greenish yellow; an interrupted orange streak along termen narrow from vein 2 to apex; markings of upper side, except stigma, reproduced in yellow and finely edged with fuscous. Cilia as above. Hindwings bright greenish-yellow; markings of upper side reproduced, but paler, and outlined finely with dark-fuscous; dorsal broadly yellow; cilia orange, with a black basal line ending at vein 1.

Types probably in Coll. Staudinger, Berlin Museum. Specimens of this species were submitted to Professor Mabille, who returned them as above.

Mackay, Townsville, Kuranda, and Cooktown. Nine specimens; from March to May; also from Celebes, whence the type came.

73. O. SUNIAS, Feld.

Pamphila sunias, Feld., Sitz., Akad., Wiss., Wien., Math., Cl., p. 462, 1860; M. and L., T.R.S., p. 101. *Apaustus Walkeri*, M. and L. (*nec* Heron); *l.c.*, *Hesperia ahrendti*, Plötz, S.E.Z., xliv., p. 230 (1883), pl. dcxcv. *Padraona sunias*, Swinh., T.E.S., 1908, pl. i., fig. 22, p. 18.

♂ ♀, 22-25 mm. Head, palpi, antennæ, thorax, and abdomen dark-fuscous; palpi beneath pale-yellowish, antennæ spotted with orange, club orange, terminal half and apiculus black, thorax and abdomen beneath yellowish. Legs orange-yellow; coxæ paler. Forewings shaped as in *rectivitta*, blackish, with orange markings; markings in ♂ as in *rectivitta*, but all much broader than in that species, band nearly twice as wide, and the apical spot (representing subapical series) generally enlarged so as to touch apical spot of band and cellular spot; stigma and cilia as in *rectivitta*. Hindwings blackish; basal hairs, cellular spot, and postmedian band as in *rectivitta*, but the band, especially in ♀, twice or more than twice as wide, and the spot on apex of band is *rarely separated in either sex* (it generally is in *rectivitta*); cilia as in *rectivitta*. Under-side of both wings, colour markings, etc., reproduced as in *rectivitta*, excepting that markings are enlarged as above. I think this and the former species are distinct enough at *present*, the ♀ in each species especially so. It is highly probable that as our knowledge of this difficult group is advanced intermediate forms may be discovered which will necessitate placing them under one species.

Rectivitta differs chiefly from *sunias* by the narrower markings and position of apical spots of both fore and hind wings; the ♀'s of the former are distinctly and easily separable from those of the latter; but the ♂'s are more, yet not difficult of separation, although some specimens of *rectivitta* approach them closely. Colonel Swinhoe lent me specimens of authentic *sunias* from the Solomon Islands which are *exactly* similar to specimens in Mr. Waterhouse's collection from Murray Island taken in September. The Australian specimens (also those from New Guinea) have the markings above slightly narrower than the Island forms. Swinhoe's figure is not good, and the sex is not mentioned. It appears to represent a different insect from the one under review, but the species I have called *sunias* is typical of those standing in the British Museum under that name.

Type (? in Coll. Tring, Museum).

Kuranda, Cooktown, Queensland; Port Darwin; from January to May. Eighteen specimens. I have seen specimens from Celebes and New Guinea. Felder's type came from Amboina.

74. O. HYPOMELOMA, n. sp.

♂ ♀, 24-28 mm. Head, palpi, antennæ, thorax, and abdomen dark-fuscous; palpi whitish beneath, antennæ annulated with whitish, thorax and abdomen clothed above with yellowish hairs, beneath whitish. Legs yellow, mixed with fuscous: ♂ with stigma. Forewings elongate, triangular, costa straight, termen gently bowed; dark-fuscous, with orange markings; a streak along costa, from base to vein 9, leaving a narrow costal streak of ground-colour on extreme edge; in ♀ the yellow streak is interrupted in middle by ground-colour; cell filled in with orange, in ♀ interrupted by intrusion of ground-colour; 3 moderate, cartridge-shaped, subcostal spots at about $\frac{2}{3}$ from base, upper one about $\frac{1}{3}$ the size of other 2, lower one in ♂ tending to touch costal streak; an oblique transverse band of 5 irregularly cartridge-shaped spots, posterior edges excavate, anterior edges obtuse, lying between veins 1 and 6, upper 2 half the size of remaining 3; stigma narrow, obscure, lying between veins 1 and 4, and closely appressed to anterior edge of 3 lower spots of oblique band; a narrow dorsal streak, from base to near anal angle; cilia dark-fuscous, becoming yellowish round anal angle. Hindwings with termen rounded, slightly prominent on vein; dark-fuscous; markings orange; basal hairs orange; a roundish spot in cell; an oblique band of 5 spots as in forewing, lowest spot continued along vein 1 to base and termen, more obscure in ♀; a small somewhat ovoid spot lying on vein 6, well separated from oblique band; cilia yellowish, mixed with fuscous at base. Underside of forewings dark-fuscous, apical and terminal area irrorated with yellow scales; markings of upper-side, except stigma, reproduced; cilia ochreous-fuscous, with a fine black line along termen. Hindwings yellowish-orange; markings pale-yellow; an ovoid spot in posterior end of cell; a cuneiform spot lying on vein 6, representing spot of upper side; 3 very oblique, cartridge-shaped spots at $\frac{2}{3}$ from base, lying between veins 2 and 6, upper one inclining to be double and reaching close to termen; indications of a suffused spot on vein 1 at $\frac{2}{3}$ from base; a well-marked elongate cuneiform black streak from base to termen; extreme dorsal edge yellow-whitish; cilia as in forewings, but becoming pale-yellow round anal angle.

This species, which appears scarce, is an excellent mimic of *Taractrocera dolon*, Plötz, but the antennæ afford an

immediate distinguishing test. In the fifteen specimens of *dolon* before me some have a small yellow fleck on vein 6 on upper side of forewing, but not of sufficient importance as to confuse it with the present species. From its general appearance it is probable that it has been overlooked by being confused with *Walkeri*.

Herberton and Kuranda, Queensland; in March.

One ♀ specimen *(Dodd)*, Roseville, near Sydney; two ♂ specimens; in April *(Waterhouse)*.

Types in Coll. Lower.

14. PADRAONA, Mre.

Lep., Ceylon, vol. i., p. 170, 1881.

Type *mæsa*, Mre.

I have examined a specimen of ♂ *dara*, Koll., and the generic characters differ from *Ocybadistes* only by the *absence* of stigma of ♂, vein 2 practically equidistant from end of cell and base of wing, twice as far from 3 as from 4. In the hindwings of ♀ vein 2 is sometimes exactly midway between 3 and base. Elwes and Edwards place this genus as a synonym of *Telicota*, Mre., but I prefer to keep them separate, as it is desirable to prevent the group becoming unwieldy and more difficult.

75. P. LASCIVIA, Rosen.

Pamphila lascivia, Rosen., Ann. Mag., N.H., 1885, p. 378, pl. ii., fig. 1. *Apaustus lascivia*, Waterh., P.L.S., N.S.W., 1897, p. 244; Vict., Butt., 1894, p. 113; M. and L., T.R.S., p. 100. *Pamphila neocles*, Mab., Cont. Rend. Soc., Ent. Belg., vol. xxxv., p. 177, 1891.

I sent specimens of this species to Professor Mabille, who returned it as *Padraona neocles*, Mab.

Colonel Swinhoe suggested forming a new genus to receive this species, but I am unable to discern any different characters by which a new genus could be safely erected, excepting perhaps that this species has somewhat broader wings than some of its congeners. The specimens from the Cairns and Herberton districts in North Queensland have the ground-colour of wings nearly black, and the markings both above and beneath much more sharply defined than those from the southern districts, but they do not warrant a distinctive name.

Type in ——? British Museum.

Victoria, Tasmania, New South Wales, and Queensland. Thirty-nine specimens; from November to March.

76. P. HETEROBATHRA, Low.

Apaustus heterobathra, Low., T.R.S., S.A., p. 316, 1908.

Types in Coll. Lower.

I have specimens from Ké, consequently I hazard the opinion that in all probability it has been previously described. On comparing the figure of *Taractrocera (Hesperia) aliena*, Plötz (from Java), T.E S., 1908, pl. i., fig. 20, it appears to approach that species closely. Colonel Swinhoe, to whom I submitted specimens, returned it as unknown to him.

Mackay, Cairns to Port Darwin. Ten specimens; from January to March.

Note.—It may be desirable to mention that *Ocybadistes (Hesperia) flavoguttata*, Plötz, S.E.Z., xliv., pl. 696, p. 231, 1883, which is said to be from Australia, is represented in the British Museum by specimens of *O. Walkeri* from Sydney. I am satisfied that the identification is erroneous. I do not mean to insist that *flavoguttata* is not to be found in Australia, but that Plotz's figure does not represent *Walkeri*. Plötz's type came from Manila, and Colonel Swinhoe figures it in T.E.S. (pl. ii., fig. 14, p. 21, 1908). The late Dr. Staudinger sent me 5 specimens labelled "Australia (?)" *flavoguttata*, but they are specimens of *Taractrocera ziclea*, Plötz, and I think there is a mistake in the locality. I may say, *en passant*, that the same five specimens have been identified for me as *Telicota dara*, Koll., but this is purely an haphazard guess, as the antennal club is characteristic of *Ziclea*.

15. TELICOTA, Mre.

Lep., Ceylon, i., p. 169, 1881; M. and L., T.R.S., p., 102.

Type *augias*, Linn.

Antennæ more than half as long as costa, club stout, moderately long, apiculus pointed, bent, as long as, or longer than greatest width of club. Palpi erect or suberect, *terminal joint stout, short*, bluntly pointed. *Forewings in ♂ with stigma;* 2, 3, and 4 practically equidistant in ♂; in the ♀ 3 and 4 are closely approximated at base, and 2 is widely remote from 3, being midway between 3 and base of wing; in both sexes 5 is approximated to 4 toward base. Hindwings with 5 absent; 2, 3, and 4 somewhat approximated toward base; 3 is nearly twice as far from 2 as from 4; posterior tibiæ with all spurs.

As restricted by me *Telicota* will embrace those species with the above characters: the genus as thus constituted principally differs from *Padraona*, Mre., by the presence of the discal stigma, position of vein 2 of forewing, and stouter

palpi; and from *Ocybadistes*, Heron, by the stouter terminal joint of palpi, different form of stigma, and relatively large size. In a group so difficult as this it is necessary to utilize any character of value which will facilitate accuracy in determining the various species, and I trust that the characters as herein delineated may prove as useful as I intend them to be, as the varieties mentioned are easily recognizable.

77. T. AUGIUS, Linn.

Papilio augias, Linn., Syst., Nat., p. 794, 1767. *Pamphila Krefftii*, Macl., Proc. Ent. Soc., N.S.W., p. 54, n. 20, 1866. *Pamphila ancilla*, Herr.-Sch., S.E Z., p. 79, n. 59, 1869. *P. olivescens*, *ib.*, *l.c.*, n. 60, fig. 14, t. 3, 1869; *ib.*, ex Schmett, ii., p. 116. *Hesperia argeus*, Plötz, S.E.Z., xliv., p. 229, n. 704, 1883 *H. augustula*, Plötz (*nec* Herr.-Sch.), *l.c.*, n. 705. *Telicota augias*, Dist. Rhop., Malay, p. 382, pl. xxxiv., fig. 23, 1886; M. and L., T.R.S., p. 105.

As neither Elwes nor Swinhoe gives *sagara*, Mre., as a synonym I will refrain from doing so.

This species is subject to considerable local variation; that is, *if* all the species ranged as above are one and the same variable species. I cannot bring myself to consider it of such a variable nature as to embody insects ranging in size from 25 to 44 mm. and in markings varying in size, intensity, and position. In the past it seems to have been considered satisfactory enough to consider any deviation of the type pattern in this group (*Telicota*) to be a variety of *augias* without considering the matter thoroughly; it certainly is a very simple manner of disposing of any difficult deliberations, but is not satisfactory. It seems singular that this one unfortunate species should be singled out for such notoriety. I admit that it does vary; but not to the extent attributed, and until a thorough and exhaustive study of the various species of this (*Telicota*) group is made from considerable material from Australia and the adjoining islands confusion must reign. To give an instance, I had *typical* ♂ specimens of *bambusæ*, Mre., identified by a leading authority as "*augias*, without doubt," and the ♀ was identified as a variety of *augias*. I sent the *identical* insects to another eminent writer, and the ♂ was given as probably *bambusæ*, and the ♀ as *olivescens*, Herr.-Sch. Leaving out the Indo-Malayan species, I find that the Australian specimens, which range from Sydney to Port Darwin, resolve themselves into the following well-marked forms. I cannot consider them local races, because in some districts one or more varieties occur in the same locality. Perhaps some of them will ultimately be raised to the rank of species.

77A. Var. I. T. AUGIAS, Linn.
(including *kreffti*, Macl., and *argeus*, Plötz).

Wings above fuscous, *markings yellow;* markings of subterminal band continued as fine lines along *both edges* of veins to termen. Under side of hindwings yellow. Markings of upper side reproduced in dull-orange; median band margined with fuscous lunules; stigma broad, entire, edged with blackish. This I consider typical *augias*, and I have specimens from Sydney, New South Wales: Townsville, Queensland; and Port Darwin. *Argeus* and *kreffti* differ from typical *augias* only by the paucity of markings of under-side of hindwings. It would be interesting to learn what Plötz considered *augias*, as, curiously enough, when showing the relationship of these several species he mentions *augias*, and gives *sagara*, Mre., *kreffti*, Macl., and *ancilla*, Herr.-Sch., as synonyms.

Argeus and kreffti are practically confined to the Cape York district, so far as I am aware.

78. Var. II. T. ANCILLA, Herr.-Sch.

♂, *Pamphila ancilla*, Herr.-Sch., S.E.Z., p. 79, n. 59, 1869. ♀, *P. olivescens*, *ib.*, *i.l.*, n. 60, 1869; *ib.*, ex. Schmett, ii., p. 116. *Telicota bambusæ*, M. and L. (*nec* Moore), T.R.S., p. 107.

Wings above dark-fuscous, *markings deep-orange;* markings of subterminal band continued as fine lines to termen along *lower edge* of veins only. Under-side of hindwings varying from greenish to dull-olive greenish; markings of upper side reproduced as in var. i. rarely absent. Stigma from moderately broad to broad, edged with blackish. This is the commonest Australian form, and extends from Sydney to Port Darwin. The green under side is very beautiful in freshly-bred specimens, but it rapidly fades. Curiously enough, the females show the greenish tinge more strongly than the opposite sex. As will be noticed, Herrich-Schäffer gave the sexes different names, and although they show slight variations there is no doubt that the two sexes represent but one species. *Olivescens* is well figured in S.E.Z., and is quite recognizable. Of this species Schäffer says:—"Unten das Spitzendrittel der V. fl und de H fl von Z, lb am bleich olivegrün, M Fleck und Band der letzteren kaum angedeutet; gelblicher, *ohne schwarze Mondchen.*" It is true that many ♀ specimens are without the black lunules of under side of hindwing, but it is not a reliable character, as every intermediate form occurs. The band of upper side is reproduced in varying degrees of intensity, but is always delineated. We formerly called this *bambusæ*, Mre.

79. Var. III. T. AUGUSTULA, Plötz.

This is very similar to *ancilla*, but the markings are more broadly defined, deeper orange, and the under side of hindwings is bright orange with scarcely any markings. Stigma as in *ancilla*, but narrower. This is not the *augustula* of Herr-Sch., and that species is referable to *Corone*. Plötz identified the species wrongly. This variety is scarce. My four specimens are from Mackay and Cape York, and were taken in November and December.

80. Var. IV. T. MESOPTIS, *nov. var.*

Wings above blackish, markings orange; subterminal band in both wings narrow, half the width of that in *ancilla*. Lower edge shortly produced, not nearly reaching termen. Under side of hindwings dull-olive greenish. Band of upper side reproduced in dull-orange and edged with black lunules. Stigma very narrow.

This variety is nearest *brachydesma*, Low., and appears to fluctuate between that species and *eurotas*, Feld., differing from both by the under-side of hindwings.

My specimens are all from the Kuranda district, taken in March, April, and May.

Before closing my remarks on this species I may state that although but four well-marked varieties are mentioned there are several slight minor varieties. These need not disturb the general scheme, as they can be easily assigned to the different varieties. The whole of the species mentioned vary little as regards size, the ♂'s being from 24 to 26 mm. and the ♀'s from 25 to 32 mm.

81. T. ANISODESMA, n. sp.

Type in Coll. Lower.

♂, 40-42 mm. Head, palpi, antennæ, thorax, and abdomen fuscous, palpi beneath orange, antennæ beneath banded with blackish. Club beneath yellow, thorax and abdomen clothed with orange hairs above and beneath. Legs orange. Forewings elongate triangular, termen gently bowed, dark fuscous, with orange markings; stigma oblique, moderately broad; a broad costal streak from base to extremity of vein 12; cell filled in with orange; interspaces between veins 12 and 9 filled in with orange, quite or nearly reaching costa; an elongate spot at base of veins 7 and 8 continued as fine lines along both edges of veins to termen; 3 moderately large irregularly subquadrate spots lying on veins 1, 2, and 3 respectively, posteriorly excised and lower edge more or less continued as a fine line along vein to near termen; 2 small simi-

lar spots lying on veins 4 and 5; the whole 5 forming an oblique series, but last 2 nearer termen; a moderate dorsal streak from base to near anal angle. Hindwings with termen rounded, somewhat prominent on vein 1; dark fuscous with orange markings; basal hairs orange; an ovate spot in cell; a transverse row of four moderately broad, somewhat cartridge-shaped spots, separated by veins; anterior apices obtuse, posterior excised, that on vein 1 continued along vein to termen; cilia of forewings fuscous, becoming orange round anal angle; cilia of hindwings orange, becoming fuscous round apical third. Under-side of both wings orange-yellow, markings of upper-side, except stigma, reproduced; dorsal and basal area of forewings dark-fuscous; transverse markings of forewings edged anteriorly and posteriorly with blackish lunules; cilia more yellowish; band of hindwings clearer orange and edged anteriorly and posteriorly with black lunules; cilia orange, with a black terminal line at base not extending beyond vein 2.

I do not know the ♀ of this species. The ♂ is very like ♂ *bambusa*, Mre., from India, and is probably the Australian representative of that species. It appears to differ by the somewhat narrower transverse markings of both wings, the continuation of the lower edge of markings of forewings to termen, and especially by the unevenness of the anterior edges of the 5 transverse spots of forewings, which in *bambusæ* are usually even and limited by the stigma, while on the under-side the blackish lunules are much enlarged in comparison with *anisodesma*. Moore's figures of *bambusæ* (P.Z.S., 1878, p. 45), Nos. 11-12, are fair. They do not figure the under-side, but the upper-side of both sexes show the transverse band of forewings with the internal edge quite straight. Moore's original description *(l.c.)* reads:—"*Pamphila bambusæ*, allied to *augias*, Linn., from typical Java specimens of which it differs in its somewhat broader and less pointed wings. Markings above similar, but more defined; the borders of the wings blacker, the basal yellow streak on hindwing confined to a terminal spot at end of cell, and the abdominal border black. On the underside the markings are also more clearly defined and the interspaces blacker."

I have seen seven male specimens of *anisodesma*, and they do not vary from the description given. The nearest approach to the Indian and Sarawak specimens of *bambusæ* is the specimen from Mackay. The other specimens are from Richmond River *(Waterhouse)*, Townsville *(Dodd)*, and Brisbane *(Illidge)*, and were taken in March and April.

82 T. EURYCHLORA, Low.

T.R.S., S.A., p. 314, 1908.
Types in Coll. Waterhouse.
Ballina, Richmond River; in February

83. T. BRACHYDESMA, Low.

T.R.S., S.A., p. 312, 1908.
Types in Coll Lower and Waterhouse.
Kuranda and Cooktown, Queensland; March and April.

84 T. OHARA, Plötz.

Hesperia ohara, Plotz., S.E.Z., 1883, p. 226; M. and L., T.R.S., p. 104.

Having received both sexes and fresher specimens I re-describe the species.

♂, 38 mm.; ♀, 40-48 mm. Head, palpi, antennæ, thorax, and abdomen dark-fuscous; palpi beneath yellow; antennæ spotted with yellow beneath; club beneath yellow, reddish on apical half; thorax and abdomen more or less clothed with golden-ochreous hairs. Legs orange-fuscous Forewings elongate, triangular, costa nearly straight, termen oblique, hardly rounded in ♂, slightly rounded in ♀; dark-fuscous, inclining to blackish, markings deep-orange; an elongate streak along costa from base to very near middle, absent in ♀; whole of cell filled in with orange; in ♀ only represented by either two spots, sometimes joined, at posterior end of cell, or one spot and an elongate streak along lower edge of cell; an oblique row of three quadrate spots, outer edges excised, from vein 1 to vein 4, edged on inner edge by stigma, which is entire, moderate, with outer edge straight and inner edge somewhat dentate; a row of 3 elongate, somewhat cartridge-shaped spots near apex, between veins 6 and 9, absent in ♀; between veins 4 and 6 are two small irregularly-shaped spots, making a more or less complete band from vein 1 to 9, absent in ♀; a moderate streak along dorsum; cilia fuscous, becoming orange round anal angle. Hindwings with termen rounded, slightly indented between veins 1 and 2; dark-fuscous, inclining to blackish; markings deep-orange; basal hairs orange; a roundish spot at end of cell; a submedian band of 4 spots, much narrower in ♀; two middle ones elongate, cartridge-shaped; spot between veins 1 and 2 irregularly edged and continued along vein 1 to base and termen; upper spot irregularly quadrate; cilia orange. Under-side of forewings dull-fuscous, more or less tinged with dull-olive greenish, especially on margins; markings of upper-side, except stigma, reproduced. Hindwings as forewings; markings of upper-

side reproduced: band faintly edged with fuscous; cilia orange-yellow, more pronounced at anal angle.

This species is easily recognized, especially the ♀, which is curious in having no spots between vein 4 and the apex. The ♂ is not unlike a large *bambusæ*. The under-side of both sexes has the ground-colour similar; that is, dull-olive greenish, tinged with fuscous.

Kuranda, Queensland. Five specimens; January to April; also from Mackay.

85. T. ARUANA, Plötz.

Hesperia aruana, Plötz, S.E.Z., p. 103, 1886, pl. mcccclx. *Pamphila autoleon*, Misk., P.R.S., Qld., 1889, p. 147, *Erynnis Macleayi*, M. and L. (*nec* Plötz). *Telicota aruana*, Swinh., T.E.S., pl. ii., fig. 9, 1908.

Type *aruana*, in Coll. Erhardt (Munich); type *autoleon*, Misk., in Queensland Museum.

Since seeing Plötz's drawing of *Macleayi* I am of opinion that it does not represent *aruana*, but an allied species. I am strongly of opinion that *Dobboe*, Plötz., and *Oharina*, Stgr. (M.S.S.), represent very slight geographical variations of *aruana*, the former representing the ♀, the latter the ♂. I have both from New Guinea and the Aru Islands, and the *only* difference is the more prominent cellular streak on upper-side of forewings. I place *aruana* in *Telicota*, as it possesses the ♂ stigma; otherwise it would be better placed in *Corone*, as veins 2, 3, and 4 of forewings are not equidistant. I look upon this species as forming a connecting link between *Telicota* and *Corone*, yet not necessitating forming a new genus.

Mackay to Cairns, Queensland; November to May; also from Aru Islands.

16. CORONE, Mab.

Pet., Nouv., Ent., p. 205, 1878.

Type *ismenoides*, Mab.

This genus differs from *Telicota* by the absence of stigma on either forewing or hindwing, and the position of the veins 2, 3, and 4 of forewing. In both sexes 3 and 4 are closely approximated at base, 3 from immediately before angle, 2 midway between 3 and base of wing.

Edwards and Elwes (Rev. of Hesp.) place *augiades*, which is closely allied to *sperthias*, in *Telicota*.

86. C. SPERTHIAS, Feld.

Hesperia sperthias, Feld., Verh. Zool., Bot. Geis., xii., p. 492, 1862. ♀, *Pamphila ulama*, Butl., T.E.S., p. 504, 1870. ♀, *Corone ismenoides*, Mab., Pet., Nouv., Ent. ii., p. 204, 1878. *Palmarum*, Scott, M.S.S. *Phineus*, Scott (*nec* Cram.), Aust., Lep., pl. xiv., 1890. *Erynnis sperthias*, M. and L., T.R.S., p. 113.

We formerly placed this species in *Erynnis*, Sch., but that genus is immediately known by the minute apiculus of club of antennæ, and so far as is known has no representatives in Australia. Elwes gives *comma*, Linn., as the type of the genus *Erynnis*. Mr. Meyrick, in his handbook, places that insect in *Pamphila*, Fabr.

Type ♂, in Coll. Felder; type ♀, in Coll. Mus. God.

Sydney to Cape York; from November to February. Larvæ feed on various *palms*.

Mr. Waterhouse tells me that Felder described this species from specimens obtained by Frauenfeld from A. W. Scott when in Sydney. Scott had given the M.S. name of *palmarum* to this species, according to Felder. In Scott's Australian Lepidoptera (pl. xiv., 1890) the name of *palmarum*, Scott, appears on the plate, and *phineus*, Cramer, on the explanatory plate. The latter name, *i.e.*, *phineus*, originated with Mr. G. F. Matthew, who, when breeding the species, misidentified it with the *Surinam* species. The reason why the name appears as *palmarum*, Scott, on the plate and *phineus*, Cramer, in the text is that the plates were struck off many years before the notes of Scott were published by A. S. Olliff.

87. C. TRICHOPEPLA, Low.

T.R.S., S.A., p. 315, 1908. *E. palmarum*, M. and L (*nec* Moore), *l.c.*, p. 110, 1902.

We formerly called this *palmarum*, Mre. (an Indian species), which the ♂ resembles somewhat above, but the ♀ is totally different, being similar to the ♂; whereas in *palmarum* the ♀ is dark-brown, with yellowish markings, and has not been taken in Australia up to the present.

Types in Coll. Lower.

Through the kindness of Mr. H. J. Elwes I have been fortunate enough to examine ♂ and ♀ specimens of Moore's *palmarum*. They are not to be confused with *trichopepla*. The drawings in P.Z.S. are excellent, and indicate the Indian *palmarum* with certainty. Unfortunately the under-side is not delineated.

Mackay to Port Darwin; from November to March.

88. C. AUGUSTULA, Herr.-Sch.

Pamphila augustula, Herr.-Sch., S.E.Z., p. 79, n. 58, 1869. *Erynnis augustula*, M. and L, T.R.S., p. 109.

Townsville, Queensland. One specimen; in October (Dodd). The type came from Fiji.

17. Parnara, Mre.

Lep., Ceylon, i., p. 166, 1881. Watson, P.Z.S., 1893, p 105. *Caltoris*, Swinh., T.E.S , 1893, p. 393.

Type *(Caltoris) kumara*, Mre.; type *(Parnara) guttatus*, Brem.

Antennæ as long or longer than half of costa; club moderate, apiculus distinct, as long as or longer than greatest width of club. Second joint of palpi densely scaled, terminal joint obtuse, very short, almost concealed; vein 5 nearer 4 than to 6, curved upwards from base, 2 from about middle of cell. Hindwings with 2 from apical fourth of cell, 5 absent. Hind tibiæ with two pairs spurs; ♂ without stigma.

89. P. amalia, Semp.

Pamphila amalia, Semp., Mus. God. Lep., xiv., 1878. *Hesperilla fulgidus*, Misk., P.R.S., Qld., p. 151, 1889. *Erynnis fulgida*, M. and L., T.R.S., p. 116, 1902.

Type *amalia*, in Hamburg Museum; type *fulgidus*, in Queensland Museum.

Brisbane to Port Darwin; October to December.

90. P. laraca, Swinh.

Caltoris laraca, Swinh., A.M.N.H. (7), xx., p. 434, 1907; T.E.S., pl. ii., fig. 21, 1908.

♂ ♀, 36-42 mm. Head, palpi, thorax, antennæ, and abdomen fuscous; palpi beneath pale-yellowish; thorax and abdomen haired with greenish-yellow, becoming paler and brighter beneath; antennæ beneath spotted with yellowish; club yellowish beneath; apiculus reddish. Legs reddish-yellow. Forewings elongate, triangular; costa very slightly arched, termen obliquely rounded; dark-fuscous; basal half of wing and dorsum clothed with short orange hairs; markings pale-yellowish, semi-transparent; two spots in end of cell, upper elongate, lower irregularly quadrate; an irregular transverse series of three small subapical spots lying between veins 6 and 9, middle one lying at base of veins 7 and 8; a rather elongate, somewhat quadrate spot lying at base of veins 2 and 3; a second, not quite half the size, immediately above, placed obliquely and excised posteriorly; a third, roundish, obliquely above, between veins 4 and 5; a somewhat cartridge-shaped yellow spot lying on vein 1 in middle; cilia yellowish-white. Hindwings with termen rounded, anal angle rounded, prominent; colour, orange hairs, and cilia as in forewings; two ovoid, pale-yellowish, semi-transparent spots lying beyond middle of wing between veins 2 and 4. Forewings beneath rather bright-greenish yellow or yellow, lower half of wing, which is fuscous, excepting terminal area; markings of upper-side reproduced; cilia as above. Hind-

wings bright-greenish yellow or yellow, especially in ♂; spots of upper-side reproduced, but appearing more transparent; cilia yellow.

Colonel Swinhoe places this species in *Caltoris*, Swinh. (type *kumara*, Mre.), but owing to its affinity to *colaca*, Mre., I see no reason for separating it from *Parnara*, as defined. It is somewhat like *mathias*, ♀; but the absence of stigma easily separates it.

Type in British Museum.

Port Darwin and Woodlark Island, New Guinea.

Mr. Dodd sent me a fine series, which show no variation. The footnote at end of description of *mathias*, T.R.S., S.A., p. 117, 1902, refers to this species. The type came from Woodlark Island.

91. P. COLACA, Mre.

Hesperia colaca, Mre., P.Z.S., 1877, p. 594, pl. lvii., fig. 7. *Parnara cingala*, Mre., Lep., Ceylon, i., p. 167, pl. lxx., figs. 3*a*, 3*b*, 1881. *Hesperia ureius*, Plötz, Berl., Ent. Zeit., xxix., p. 226, 1885, pl. mccccxv. *H. saruna*, *ib.*, *l.c.*, xlviii., p. 90, 1886, pl. mccccxxix.

♂ ♀, 33-38 mm. Head, palpi, antennæ, thorax, and abdomen dark-fuscous. Palpi beneath pale-yellowish, antennæ rather short, hardly half the length of costa. Thorax and abdomen clothed above with golden-ochreous hairs, beneath ochreous-whitish. Legs ochreous fuscous. Forewings elongate, triangular, costa straight, termen oblique, slightly bowed; dark-fuscous, markings whitish, semi-hyaline; a transverse row of 3 small subapical spots, upper one often absent; a somewhat quadrate spot at base of veins 2 and 3; a small cartridge-shaped spot at base of veins 3 and 4; a small spot nearly at base of veins 4 and 5; some golden hairs along dorsum; cilia ochreous-fuscous, darker on basal half. Hindwings with termen rounded; generally two small dots in middle of wing at $\frac{2}{3}$ from base, sometimes obscure; cilia as in forewings. Forewings below dark-fuscous, costal, apical, and terminal areas finely irrorated with pale-ochreous; markings of upper-side reproduced. Hindwings below dark-fuscous wholly irrorated with pale-ochreous scales, markings of upper-side reproduced, somewhat obscure.

Swinhoe says (T.E.S., p. 23, 1908):—"At the end of the cell of forewings there are generally two spots. Sometimes only one and sometimes both are obsolescent; in the figures on pl. mccccxv. there is only one; in pl. mccccxxix. both are absent. I have Indian examples like both."

De Niceville, in writing to Mr. Rowland Turner, says:—"*Parnara colaca*. This agrees exactly with specimens from

India. I expect it has probably been separately described from Australia."

Described from Australian specimens.

All the specimens I have seen are similar, and do not vary from my description. Mr. Turner states that our species does not agree with those *colaca* in British Museum.

Mackay, Atherton, and Kuranda, Queensland; in April.

92. P. IMPAR, Mab.

Pamphila impar, Mab., *l.c.*, pl. xvi, vol. xxvii., 1883.

"Niger, alæ latæ; anticæ tria puncta offerentes, in seriem obliquam inter ramos; unum minimum ante cellulum, unum quadratum, magnum, albo argenteum inter primum et secundum ramum nervi compositi posterioris, et unum fere triangulare ad nervum simplicem, subluteum. Anticæ subtus apice rufescentis easdem maculas gerunt. Posticæ griseæ habent tria puncta albida, unum ad margineum anticum, et duo paulo inferius approximantia" "Le dessus des ailes est d'un brun foncé presque noir. Les ailes inférieures ont trois points blancs transparents en ligne oblique entre les rameaux; le premier est très petit, et le troisième, triangulaire, est placé contre la nervure simple postérieure et tenite de jaune pâle. Le dessous des ailes supérieures a l'apra et la côte lavés de rougâtre, avec les points du dessus plus marqués. Les ailes inférieures sont d'un brun grisâtre luisant, avec trois points blancs auprès du bord antérieur et deux du dessous, rapprochés et placés entre les rameaux. Le corps est brun. Une femelle d'Australie et onde Océanie." Apparently something like some forms of *colaca*, Mre.

93. P. SIGIDA, Mab.

Pamphila sigida, Mab., Comp. Rend. Soc., Ent. Belg., vol. xxxv., p. 177, 1891.

"Brun noir. Ailes supérieures à points et à taches blanc jaunâtre, transparents, savoir-trois pointe apicaux allongées, en ligne droite; trois taches sur le disque dans les intervalles, 2, 3, et 4 et ombrées de noir foncé intérieurement; deux petits points blanc jaunâtre au bout de la cellule. Inférieures avec trois points diffus sur le disque dans les intervalles, 4, 5, et 6. Frange jaune roussâtre. Dessous des supérieures noirâtre à la base, et brun rougeâtre sur la moitié terminale, taches reunies sur le disque. Inférieures brun rouge avec une éclaircie correspondante aux taches du dessus. Corps brun foncé, ventre blanchâtre ainsi que la poitrine et les palpes." 30 mm., Australia.

The description of this species (which I fail to recognize) reads somewhat like *amalia*, Semp., but it cannot be that

species, as Mabille returned specimens as unknown to him with the words "*Parnara* (groupé *sèguttata*), Br." Possibly this and the former are not Australian. I refer them to *Parnara* with some doubt, but they appear rightly referred.

18. CHAPRA, Mre.

Lep., Ceylon., i , p. 169, 1881.

Type *mathias*, Fabr.

This genus differs from *Parnara* only by the presence of stigma of ♂.

94. C MATHIAS, Fabr.

Hesperia mathias, Fabr., Ent. Syst. Supp., p. 433. n. 289, 290, 1798. *Hesperia thrax*, Led., Verh. Zool. Bot. Geis., Wien., 1855, p. 194, pl. i., figs. 9-10. *Chapra mathias*. Mre., Lep., Ceylon, i., p. 169, pl. lxx , figs. 1 and 1*a*, 1881. *Baoris mathias*, Dist. Rhop. Malay, p. 380, pl. xxxv., fig. 10, 1886. *Erynnis mathias*, M. and L., T.R.S., p 117

Elwes and Edwards (Rev. of Hesp.) give *agna*, Mre., as a synonym. Colonel Swinhoe considers it distinct.

Brisbane to Cape York, Port Darwin; from October to May; also from India, Java, Borneo, etc.

19. SABERA, Swinh.

Trans. Ent. Soc., p. 30, 1908

Type *cæsina*, Hew.

Palpi upturned, thickly hairy; *antennæ two-thirds length of costa;* club rather long and even, not thick; apiculus short and curved. Forewing with vein 2 from about middle of cell, 3 from lower end, 4 from end, 5 below middle of discocellular, 6 and 7 from upper end, 8 from close to upper-end, 12 ending on costa well beyond upper-end of cell; hindwings with vein 4 from end of cell, 2 and 3 from close before end at equal distances apart (*? 5 from middle of discocellular)*, 6 and 7 from upper end, 8 coincident with 7 for a short distance from the base, thence well separated.

We formerly placed the type of this genus, *i.e.*, *cæsina*, in *Erynnis*, Sch., but the antennæ of this species and the following were discordant characters, as the length (⅔ of costa) indicated a different genus. I have followed Colonel Swinhoe in the generic description, but can find no vein 5 on hindwing; possibly this is a printer's error or *lapsus calami*.

The sexes are similar; the ♂ has no perceptible stigma, but has a peculiar small ovoid membranous spot lying on vein 1 just inside the small white spot at end of white band of forewing. It is easily passed over, but is constant, and may, and probably does, indicate an embryo stigma. The white discal macular band of forewings is narrower and more abbreviated

in the ♀. Mabille referred *cæsina* to *Acerbas*, De Nic., of which *anthea*, Hew., is the type.

95 S CÆSINA, Hew.

Carystus cæsina, Hew., T.E.S. (3), ii., 491, n. 15, 1866, ex. Butt., v. Hesp., t. 6, fig. 57, 1873. *Pamphila albifascia*, Misk, P.R S., Qld., p 148, 1889. *Erynnis cæsina*, M. and L., T.R.S., p. 118. *Sabera cæsina*, Swinh, T.E.S., p. 31, 1908.

Type *cæsina*, in Coll. Hewitson (British Museum); type *albifascia*, in Coll. Miskin (Brisbane Museum).

Cairns, Queensland; from December to April; also from New Guinea, North Borneo, and Humboldt Bay.

96. S. FULIGINOSA.

Pamphila fuliginosa, Misk., P.R.S., Qld., vi., p. 147, 1889; ♀ ♂. *ib.*, Ann. Qld. Mus., p. 76, 1891. *Erynnis fuliginosa*, M. and L., T.R.S., p. 115.

Types in Coll. Miskin (Queensland Museum).

Mackay to Cairns, Queensland; from January to May.

I think at present it would be better to widen the characters of *Sabera* by adding ♂ sometimes with stigma than to erect a new genus for this species It is structurally similar, excepting that the ♂ has a stigma. It is an easily recognized species, the snow-white cilia of hindwings being specifically distinct and noteworthy. Probably it is more nearly related to *Telicota*.

97. S. (? CARYSTUS) VALLIO, Mab.

Comp. Rend. Soc., Ent. Belg., 1883, vol. xxvii., p. 60.

Rufo-fuscus; alæ anticæ cum triplici serie macularum; ad costam ante apicem sunt tria puncta alba hyalina, duæ maculæ in cellula junctæ et duæ aliæ inter ramos, coaduntæ luteo hyalinæ. Alæ posticæ immaculatæ, fimbria subfulva, alæ subtus viride variegatæ. Anticæ rubidæ cum marginis externi parte superiore et margine interno lilacino. Posticæ rubidæ cum vitta media cinereo lilacino.

Les trois séries de taches des ailes supérieures diffèrent de couleur. Les trois points apicaux sont d'un blanc transparent; les taches de la cellule et du disque sont réunies deux par deux, également hyalines, mais jaune paille. Le dessous des ailes inférieures est traversé, en son milieu, par une bande courbe d'un gris lilac; le corps est concoloré, les palpes et la poitrine sont gris cendré. Le dernier article des palpes est aciculé droit et noir.

Nouvelle Hollande.

This description reads somewhat like *Hesperilla Doubledayi*, Feld., ♀, but the green (viride variegatæ) under-side does not agree with that used. I sent *Doubledayi* ♂ to

Mabille, who returned it with the remark "Jén ai ♂ sans nom," so that it is hardly likely he would fail to recognize the ♂—that is, supposing his description refers to a ♀, which is uncertain, as he gives no clue to the sex or size of same. I do not know this species, and am placing it here provisionally.

20. NOTO CRYPTA, De Nic.

Jour. Bomb, N.H. Soc., 1889, p. 188; Watson. P.Z.S., 1893, p. 112. *Plesioneura*, Feld., Wien., Ent. Mon., vi., p. 29, 1862 (*nom præocc*).

Type *curvifascia*, Feld

Club of antennæ elongate, moderate, apiculus pointed, bent. Palpi subascending, terminal joint short, obtuse, porrected Posterior tibiæ with all spurs, rather long. Forewings in male without stigma; 3 from rather near 4; 5 much nearer to 4 than to 6; 2 much nearer to base of wing than end of cell. Hindwings with vein 5 practically obsolete.

98. N. FEISTHAMELI, Bdv.

Thymele Feisthamelii, Bdv., Voy., "Astrolabe," Lep., p. 159, pl. ii., fig. 7, 1832; *Plesioneura curvifascia*, Feld., Wien., Ent. Mon., vi., p. 29, 1862. *P. alysos*, Mre., P.Z.S., 1865, 789; *ib.*, Lep., Ceylon, i., p. 178, pl. lxviii., fig. 3 ♂, 3*a* ♀, 3*b* larvæ and pupæ, 1881; *P. albifascia*, *ib.*, P.Z.S., 1878, p. 843. *P. restricta*, *ib.*, *l.c.*, p. 178, 1881. *P. waigensis*, Plotz, Berl., Ent. Zeit., xxvi., p 263, 1882, pl. ccxl. *P. volux*, Mab., Ann. Soc., Ent. Belg., 1883. p. 56. (?) *P. clavata*, Stand., *Iris*, ii., p. 153, pl. ii., fig. 9, 1899. *N. Feisthamelii*, M. and L., T.R.S., p. 119.

A variable species. All the varieties represent but one species. The Australian form is *restricta*, Mre. I have specimens varying in size from 25 to 46 mm., and the subapical spots number from 2 to 5.

N. waigensis, Plötz, figured by Colonel Swinhoe, T.E.S., pl. iii. fig. 10, is an excellent drawing of our species from Evelyn Scrub, Cairns.

Mackay to Cape York, Queensland; from November to April; also from India, Borneo, New Guinea, etc.

21 BADAMIA, Mre.

Lep., Ceylon, i., p. 156, 1881.

Type *exclamationis*, Fabr.

Club of antennæ elongate, apiculus pointed, bent. Palpi ascending, terminal joint long, slender, slightly swollen near apex, obtusely pointed, porrected. Posterior tibiæ with all spurs. Forewings in ♂ without stigma, 5 parallel and equidistant to 4 and 6. Hindwings with 3 and 4 remote. Five present. Contains only the following species.

99 B. EXCLAMATIONIS, Fabr.

Papilio exclamationis, Fabr., Syst. Ent., p. 530, 1775, Mre., Lep., Ceylon, i., p. 157, pl. lxvi., figs. 2*a*, 2*b*, 1881. *P. ladon*, Cr., Pap., ex., iii., pl. cclxxxiv., fig. *c*. ♀, *Ismene thymbron*, Feld., Sitz., A. K. Wiss., Math. Nat., clxl., p. 461, Lep., p. 14, 1860. *B. exclamationis*, M. and L., T.R.S., p. 120.

Sydney to Cape York, Port Darwin, also India, North-West Himalyas, etc.; from October to December.

22. HASORA, Mre.

Lep., Ceylon, i., p. 159, 1881; Watson, P.Z.S., 1897, p. 127.

Type *badra*, Mre.

Club of antennæ moderate, elongate, apiculus pointed, bent. Palpi ascending, terminal joint slender, long, slightly swollen near apex, obtusely pointed, porrected. Posterior tibiæ with all spurs. Forewings in male without stigma, 1*b* distorted downwards near base, 5 parallel to 4 and 6, approximated slightly at base. Hindwings with 3 and 4 closely approximated basally; 5 present An Indo-Malayan genus of moderate extent.

100. H. HASLIA, Swinh.

Ann. Mag., N.H. (7), iii, 107. *H. bilunata*, M. and L. (*nec* Butl.), T.R.S., p. 122.

We formerly called this species *bilunata* and queried *haslia* as a synonym. I am now satisfied that the identification was erroneous; *haslia* is a true *Hasora* and a good species, while *bilunata* is a *Parata*, with the male stigma conspicuous.

Brisbane, Queensland; in November.

101. H. DOLESCHALLI, Feld.

Ismene doleschallii, Feld., Sitz., Akad., Wiss., Wien., Math. Cl, p. 460, 1860; Reis., Nov., Lep., iii., pl. lxxii., fig. 16, 1867. *H Doleschallii*, M. and L., T.R.S., p. 126.

Felder's coloured figures are variable and indifferently delineated. Vein 1*b* in this species is distorted very little; the same peculiarity is observed in *Albertsi*, Oberth., from New Guinea, which is allied to *Doleschalli*, but is immediately separable by the tuft of hair on upper-side of hindwing of ♂ on vein 1 near anal angle.

Cooktown to Cape York, Queensland; in December; also from New Guinea, etc.

102. H. DISCOLOR, Feld.

Goniloba discolor, Feld., Wien., Ent. Mon., p. 405, 1859. *Ismene discolor*, Feld., Reis., Nov., Lep., iii., pl. lxxii., fig. 17, 1867. *H discolor*, M. and L., p. 123.

Richmond River, New South Wales, to Cooktown, Queensland; in November and December.

23. Parata, Mre.

Lep., Ceylon, i., p. 160, 1881.

Type *chromus*, Cr.

This genus differs from *Hasora* only by the presence of the stigma in ♂, which is somewhat crescentic. The genus is useful in separating the two groups.

103. P. chromus, Cr.

Papilio chromus, Cr., Pap., ex., pl. cclxxxiv., fig ♀, ♂, 1782. *Parata chromus*, Mre., Lep. Ceylon, i., p. 161, pl. lxv., fig. 1, 1881. *Hasora chromus*, M. and L., T.R.S., p. 125 (*nec* Cramer). *Hasora lucescens*, Lucas, P.R.S., Qld., xv., p. 138, 1899.

♂ ♀, 42-48 mm. Head, thorax, and abdomen dark-fuscous, more or less densely clothed with greenish-golden hairs; face ochreous; palpi and antennæ dark-fuscous; palpi beneath ochreous-fuscous Legs ochreous-fuscous. Forewings elongate, triangular; costa nearly straight, termen nearly straight, oblique: dark-velvety fuscous, almost blackish in some specimens; basal hairs greenish-golden; markings whitish in ♀; male without markings, except stigma, which is densely black: moderately narrow and curved inwards from base of vein 3 to dorsum before middle; a somewhat triangular spot near base of veins 3 and 4; a similar spot, excised posteriorly, obliquely below, between veins 2 and 3; sometimes a minute subcostal spot between veins 6 and 7, usually absent; cilia dark-fuscous, tips whitish. Hindwings with termen somewhat produced on vein 1; colour, as in forewings; basal hairs greenish-golden; dorsum broadly dull-light fuscous; cilia as in forewings. Under-side of both wings fuscous, washed with bluish-purple; cell of forewings blackish, markings of upper side of ♀ reproduced; dorsum broadly dull-ochreous whitish, limited by vein 1; a small similarly-coloured patch above anal angle. Hindwings with a moderately broad transverse white fascia, about 3 mm. wide; anterior edge moderately straight, posterior edge suffused and gradually mixing with ground-colour, from costa at $\frac{3}{5}$ to vein 1*b*; a large patch of velvety black on anal angle; an obscure dull-whitish streak along vein 1*a* to base; a small white patch on dorsum, just above anal angle; cilia as above, blackish on anal angle, and with a fine white basal line between veins 1*b* and 3.

The insects formerly described by us as *chromus* were small specimens of *haslia*, Swinh., which were known to Australian collectors as *chromus*. It was under these circumstances that Dr. Lucas renamed the present species *lucescens*. The description here given is drawn from Australian specimens, but a nice series sent me by Colonel Swinhoe from various Indian localities vary very little from our form, the

chief difference being the under side, which is not so lilacine.

Brisbane to Port Darwin: from December to March; also India, Borneo, etc.

104. P. CONTEMPTA, Herr Sch

Ismene contempta, Herr.-Sch., M.S.S., Plötz, S E.Z., vol. xlv., p. 56, n. 1167, 1886 (*nec contempta*), Herr.-Sch.

♂ ♀, 46-50 mm. Head, thorax, and abdomen brownish-fuscous, more or less clothed with greenish-golden hairs; thorax and abdomen beneath whitish-ochreous; face ochreous; palpi dark-fuscous above, ochreous-whitish beneath. Legs ochreous, fuscous-tinged. Forewings elongate, triangular; costa nearly straight; termen straight, oblique: light-brownish ochreous, darker on median portion of wings; basal pairs greenish-golden; markings in ♀ as in *chromus*, sometimes the spot between veins 2 and 3 is absent or scarcely perceptible above; apical spot well developed; stigma in ♂ as in *chromus;* cilia fuscous, terminal half whitish. Hindwings with termen somewhat produced on vein 1; colour, basal pairs and cilia as in forewings: under-side of both wings ochreous-fuscous; forewings washed with dull-purplish along costa and upper $\frac{2}{3}$ of termen, latter portion limited by an obscure violet-whitish streak, angulated near costa; markings of upper-side of ♀ reproduced: dorsum broadly dull-ochreous whitish, limited by vein 1; a small similarly-coloured patch above anal angle. Hindwings with the purplish better developed; a broad transverse white fascia about 2 to $2\frac{1}{2}$ mm. wide at greatest width, inner edge more irregular than in *chromus*, yet similar, from costa at $\frac{3}{5}$ to vein 1*b;* a large patch of black on dorsum at anal angle; an obscure whitish streak along vein 1*a* to base; a small white patch on dorsum, just above anal angle; cilia as above; blackish at anal angle and with a fine white basal line between veins 1*b* and 3.

This species appears constantly distinct from *chromus* by the different ground-colour of wings above, otherwise it is a close ally of that species; indeed, specimens of *chromus* from New Guinea, identified as such by Colonel Swinhoe, are scarcely perceptibly different, and personally I consider the single specimen submitted to him *is contempta*. The *under-side* of the abdomen of the present species is ochreous-fuscous; in *chromus*, including the Indian specimens, it is fuscous, with the segmental margins distinctly whitish or white. Whether this peculiarity is of any practical utility in separating the two species remains to be seen. I would not insist on the point, although it is quite constant in all the specimens before me. Plötz's drawing of the ♀ (No. 1167) does

not refer to the present species, and I have not met with a specimen agreeing exactly with the figure, the hindwings of which show a narrow (1 mm.) white, somewhat waved, fascia, edged internally with half its width of brownish-red; the wing between this and base is dull light-chocolate, and between the white fascia and termen lilacine becoming brownish on termen In Plötz's description he says, "Hindwings, under-side, with narrow white band." The other ♀ figure (called a ♂) delineates our species with certainty, but it cannot be a ♂, as the figure delineates the two lunate spots, which are absent in that sex, of the species under review, as mentioned in my description *(vide supra)* It is curious that neither of the figures shows the apical dot. I therefore consider that the species should stand as *P. contempta*, Herr. Sch., and Plötz's species, when discovered, will require a new name.

Townsville to Port Darwin; from November to March. The type came from Cape York *(vide* Plötz).

105. P. CONTEMPTA, Plötz.

S.E.Z., xlv., p. 56, 1884.

I append Plötz's description (translated by Mr. Waterhouse), which may prove useful in identifying the species. I have arranged the terminology in keeping with that adopted in this paper:—

"*Ismene contempta*, Plötz., S.E.Z., xlv., p. 56, 1884, pl. dclxvii. Upper-side blackish-brown, body and base of wings with green hairs, forewing—at least in ♀—with small spots or dots; those in cells 2 and 3 are hyaline or moon-shaped. *Cilia brown*. Under-side brownish-grey, suffused-violet grey. Forewings with narrow vanishing bands before the border, and a similar transverse spot at the last vein; a light mark at hinder margin. Hindwings with a *narrow white* band running from costa to anal angle, almost linear from costa to cell 1*c*, becoming undecided toward the margin; at vein 1*b* it turns toward the anal angle, where there is a large black spot."

Nearest ally, *vitta*, Butl., from the Philippines; then *chromus* of Cramer.

23-24 mm. (one wing only), Cape York.

106. P. HURAMA, Butl.

Hesperia hurama, Butl., T.E.S., p. 498, 1870. Lep., ex., p. 166, pl. lix., fig. 10, 1874. *Ismene hurama*, Miskin, Ann. Qld. Mus., p. 74, 1891. *Hasora hurama*, M. and L., T.R.S., p. 124.

Type in Coll. Druce, taken at Cape York. The British

Museum has specimens from Champion Bay and Aru Islands (*Butler*).

Mackay to Cooktown; November to February; also from New Guinea (*Meek*)

107. P. LUGUBRIS, Bdv

Thymele lugubris, Bdv, Voy., "Astrolabe," Lep., p. 160, 1832. *Hasora lugubris*, M. and L., T.R.S., p. 124.

I have but the single ♂ specimen. It is probably only a straggler from the adjacent islands. Cape York

Note.—*Parata bilunata*, Butl., from Fiji, is very close to *chromus*, Cr. I have one indifferent specimen, and it cannot be satisfactorily separated from our *chromus;* probably a series from the type locality, Fiji, might show a recognizable distinction. I consider it a doubtfully good species Colonel Swinhoe returned it as *chromus*.

Further Notes on Australian Coleoptera with Descriptions of New Genera and Species. No. XLI.

By the Rev. Canon Blackburn, B.A.

[Read October 12, 1911.]

COPRIDES.

COPTODACTYLA.

In Deutsch Ent. Zeitschr. (1909) Herr Felsche expressed the opinion that my *C. Baileyi* and *ducalis* are females of *C. glabricollis*, Hope. They are, however, perfectly distinct species. As regards *C. Baileyi*, Herr Felsche says, "Characters distinctive from *glabricollis* are '*tibiis anticis brevibus, apice acuminatis, externe inermibus*.' This sculpture is such for a *Coprid* that one can safely assume the author has had before him a specimen of *C. glabricollis* with worn tibiæ." In describing the characters that distinguish one species from another it is, I take it, usual that the author mentions first the character which he regards as the important one. A reference to my note (Proc Linn. Soc., N.S.W., 1889, p. 1251) pointing out the distinctive characters of *C. Baileyi* will show that it commences thus: (*C. Baileyi* is) "different from it (*i.e.*, *C. glabricollis*) in the clypeus being evenly rounded in front without any emargination whatever." It is quite true that I proceeded to refer to the tibiæ as being without teeth, and that Herr Felsche's opinion that that is not a valid specific character is no doubt correct. Subsequent study of *Lamellicorn Coleoptera* led me to the conclusion Herr Felsche indicates, and in fact I have myself long ago expressed it (*e.g.*, Trans. Roy. Soc., S.A., 1904, pp. 286 and 287), *viz.*, that difference in the external form of tibiæ "may be due to some attrition to which the parts in question have been exposed." I have before me a long series of both sexes of *C. glabricollis*, Hope, from numerous places in Northern Australia, and have no hesitation in saying that the clypeal character I referred to as distinctive is perfectly reliable. However, I will now add that in *C. Baileyi* the clypeus is very much shorter than in *glabricollis* (its lateral outline running out a much less distance from the hind level of the eyes and being much less oblique, so that the widest part of the head is considerably narrower than the front margin of the prothorax). The strigose sculpture of the head does not occupy

nearly so large an area as in *glabricollis*, the greater part of that segment being occupied by a smooth gibbosity which is altogether absent in *glabricollis*. The outline of the clypeus has not the upturned margin that is present in *glabricollis* Although these additional particulars are not needed to distinguish the two species, for the clypeal distinction mentioned in my description is quite sufficient, it is well doubtless that my attention is drawn to the matter, as it cannot be denied that I described *C. Baileyi* somewhat briefly, contenting myself with the mention of characters that clearly distinguish that species from those previously described in the genus.

C. ducalis, too, is very satisfactorily distinct from *glabricollis*. Apart from its size and build, which are notably larger and more massive than in any of the numerous specimens before me of *glabricollis*, it is at once distinguishable by the striæ of its elytra being all but without puncturation —those near the suture absolutely without—the lateral ones bearing extremely small punctures It may be added that its pronotum is considerably less convex in the longitudinal direction (*i e.*, viewed from the side) than is that of *glabricollis*.

I have before me what is evidently the female of one of the two Australian species of *Coptodactyla* described by Herr Felsche in the memoir quoted above, but as their author does not differentiate the females of the two, merely saying that they are altogether similar, it is impossible to give a name to my specimen. Is it not probable that the females referred to represent only one of his species, and that the female of the other remains undiscovered?

SERICOIDES.

HETERONYCIDES.

Heteronyx.

A recent visit to the Macleay Museum in Sydney has enabled me to supply information concerning two of the species mentioned in Trans. Roy. Soc., S.A., 1910, p. 230, as requiring further study. They are as follows:—

H. scutatus, Macl. A member of Group VIII. In the tabulation of that Group (Trans. Roy. Soc., S.A., 1910, p. 191) it stands beside *flavus*, Blackb., under "LL." line 8), and can be distinguished from it thus:—

M. Punctures of pronotum well defined and quite strongly impressed ... flavus, *Blackb.*
MM. Punctures of pronotum extremely fine and faint, scarcely visible ... scutatus, *Macl.*

H. marginatus, Blackb., belongs to Group VIII. In the tabulation *(loc. cit.*, p. 192) it stands beside *collaris*, under "MM." (line 1), and can be distinguished from it thus:—

N. Base of prothorax wider than base of elytra ... . collaris, *Blackb.*
NN. Base of prothorax narrower than base of elytra .. .. marginatus, *Blackb.*

STETHASPIDES.

In my recent Revision of the members of this Group of *Lamellicornes* I accidentally omitted detailed treatment of the Australian genera of the aggregate called *Stethaspides* by Lacordaire, and by him regarded as a subsection of the *Sericoides*. The first part of my Revision (Trans. Roy. Soc., S.A., 1905) contains mention (on p. 281) of that aggregate, and distinguishes it from the other Australian aggregate of *Sericoides*; but when I reached the conclusion of the latter (in the Transactions for last year) I unfortunately forgot the genera of *Stethaspides*, and also in introducing (Trans. Roy. Soc., S.A., 1908, p. 364) the group of *Sericoid* genera with claws not simple referred to them as completing my Revision instead of as completing my Revision of one of the two main aggregates into which I had divided the Australian *Sericoides*. I therefore proceed now to consider the two known Australian genera of *Stethaspides*. These have been attributed to three genera: *Stethaspis*, *Colymbomorpha*, and *Phyllococerus*. Mr. Waterhouse—the author of *Phyllococerus*—characterized the genus without specifying what he regarded as its distinctions from *Colymbomorpha*, but an examination of the diagnosis indicates the following characters (only) as likely to have been considered by him to be generic, *viz.*:—Antennæ 9-jointed, with a 3-jointed club; clypeus somewhat deeply emarginate in middle. I have the two forms before me, and cannot find any other distinction likely to be generic between them. As regards the number of antennal joints, Blanchard, the author of *Colymbomorpha*, described the antennæ of that genus quite correctly as 9-jointed: while Burmeister, by attributing Blanchard's *Colymbomorpha* to *Calonota*, and stating that the antennæ of that genus have only 8 joints, numbered the antennal joints of *Colymbomorpha* incorrectly. It is possible that Mr. Waterhouse accepted Burmeister's statement as correct, and therefore regarded "9-jointed antennæ" as a character differentiating his genus from *Colymbomorpha*, though I think this unlikely. There remain, therefore, as probably relied on by Waterhouse, the number of joints in the antennal flabellum and the form of the clypeus. In *Colymbomorpha* the flabellum has five joints in both sexes (the first two of them very short in the female, which was evidently the sex

known to Blanchard), while the flabellum of *Phyllococerus* has only three joints. I am of opinion that neither the number of joints in the antenna or its flabellum, nor the form of the clypeal outline, is a character of more than specific value among the Australian *Sericoides*, and therefore must regard *Phyllococerus* as a synonym of *Colymbomorpha*. The tabulation in Trans. Roy. Soc., S.A., 1905 (p. 281), differentiates these insects and *Stethaspis* from the other Australian *Sericoides*. The former two are from Western Australia.

The third genus referred to above (*Stethaspis*) is really very close to *Colymbomorpha*, but the different facies and very much larger size of its species differentiate it strongly, for practical purposes. It is not so easy, however, to indicate a good structural difference. Burmeister, as mentioned above, merged *Colymbomorpha* in *Calonota*, and stated the number of its antennal joints (incorrectly) as eight. He distinguished it from *Stethaspis* on that character Lacordaire placed the two genera in distinct 'subtribes" of *Melolonthides*, attributing *Stethaspis* to the "*true Melolonthides*," which was certainly a mistake, as its ventral segments are certainly not formed as in that subtribe, nor are its front coxæ transversal. Blanchard placed *Stethaspis* in the *Rutelides*, quite incorrectly, since the claws of its species are not unequal. There can be no doubt that Burmeister was right in placing it near *Colymbomorpha* in the Sericoid group. It is, however, distinguished from *Colymbomorpha* by the first four joints of its tarsi being fringed beneath more or less closely with long hairs and the apical joint with stout bristles. This is, I think, a valid generic character in the Australian *Sericoides*. It may be added that in *Colymbomorpha* the labrum projects beyond the clypeus, so as to be visible from above, while in *Stethaspis* it is completely hidden (viewed from above) under the clypeus. This, however, is not in itself a valid generic difference in the *Sericoides*.

STETHASPIS.(1)

So much mention has been made of colour in the original descriptions of the species of this genus, and the species are so variable in colour, that it is difficult to arrive at any clear appreciation of the distinctive characters. All the Australian species except *nigrescens*, Blanch., and *lætus*, Blanch., are described as "*olivaceus*," or "olive-green." *Lætus* is called "*totus læte vividi-flavescens*," and is said to have green legs.

(1) In Ann. Nat. Hist., 1903, p. 303, Mr. Arrow showed conclusively that the name *Xylonchus* used for this genus by Lacordaire and other authors (also in Masters' Catalogue) is a synonym of *Stethaspis*.

Burmeister mentioned *lætus* as perhaps identical with his *metrosideri*, thus implying that the legs of his specimen are green I have not seen any species of *Stethaspis* (except *nigrescens*) which agrees in colour with the description of any one of them. The species that I cannot doubt is *Eucalypti* is, when fresh, of a clear green colour, with the legs light ferruginous, and in many specimens the extreme lateral margins and the apex of the elytra yellow. My unique specimen of the insect that I believe to be *S metrosideri* (with which I think *lætus* is probably, as Burmeister conjectures, identical) has head, prothorax, scutellum, and legs testaceo-ferruginous, elytra olivaceous, sterna mostly pale-ferruginous, abdomen coppery. My specimens of *piliger*, Blanch., have head, prothorax, and scutellum varying from olive-brown to a distinct green, elytra clear green with narrow ferruginous margin, legs and antennæ ferruginous. An old, and probably badly-kept, specimen agreeing otherwise with *Eucalypti* is of a dull pitchy-olive colour, with legs pitchy-ferruginous, and another, probably immature, is pale grass-green. It appears to me, therefore, probable that the colours of the *Stethaspides* are liable to fade or otherwise change under various circumstances, and that in respect of most of the species they should be disregarded for purposes of identification. As there is no species (in the genus) of which the type is in Australia I am obliged to rely upon descriptions for the identification of all the species, but fortunately there are descriptions (at least fairly good) of all of them, and I am of opinion that I have them all before me (except *lætus*, if it is a valid species) and also an undescribed one. Under these circumstances a short note on each of the *Stethaspides* to set forth the grounds of my identification, in spite of colour discrepancies, seems desirable. *Stethaspides* (under the name of *Xylonychus*) bear six specific names in Masters' Catalogue, and I believe they include all the names correctly attributable to Australian members of the genus. One of these names (*Orpheus*, Fauv.), however, seems to have found its way into the Catalogue by mistake, since "New Caledonia" is the habitat its author assigned to it.

X. Eucalypti, Boisd. The original description is of little value, but nevertheless does not altogether agree with the insect commonly regarded as *Eucalypti*, inasmuch as it contains the phrase '*supra hirsutus*." Blanchard describes *Eucalypti* in seven words, "*Viridis, elytris olivaceis, pilis niveis majoribus densioribus*" (apparently a mere indication of differences from his *lætus*). Burmeister says of it "*supra glaber*," but in the notes following the diagnosis says that there are ' Borsten" on the elytra here and there between the

punctures. Probably Boisduval used an unduly strong expression in calling the insect before him "*supra 'hirsutus.'*" At any rate, I have not seen any *Stethaspis* the elytra of which are more hairy than those of *Eucalypti* as Burmeister describes it. *S. piliger* is rightly called "hirsutus" in respect of its *pronotum*, but it is a Tasmanian species, and there can be little doubt that Boisduval's type of *Eucalypti* was from the neighbourhood of Sydney. I conclude, therefore, that the descriptions (of *Eucalypti*) of the authors mentioned all refer to the large green *Stethaspis* which occurs commonly in Victoria and New South Wales; fresh specimens of which always have, as Burmeister says, long, fine, erect hairs, very thinly distributed about the base and apex of the prothorax and between some of the punctures on the elytra, and also very sparsely placed short, white, adpressed hairs in single rows in the elytral striæ. All this pilosity is very easily rubbed off.

X. metrosideri, Burm. I have little doubt that a *Stethaspis* which I met with on the Blue Mountains is this species. Its differences in colour I have already referred to. Its author describes *metrosideri* as having 16 elytral striæ, and in describing *piliger* says that it has 14 striæ. I can count 16 striæ on the Blue Mountains specimen only by including two short and obscure striæ close to the apex in a part where in *piliger*, and also in *Eucalypti*, there is only confused puncturation. Burmeister does not, I think, attribute much importance to this character, as he does not allude to the number of elytral striæ in enumerating the differences between *metrosideri* and *Eucalypti*, and he could hardly fail to include it if there were a difference in the number of well-defined entire striæ, for that would be a much stronger and more conspicuous distinction than any that he specifies. He says that in *Eucalypti* the clypeus is more closely punctulate, that the long erect hairs of the upper surface and ventral segments are wanting in *metrosideri*, and that the hair fringes of the legs are longer and the tarsal bristles feebler in *Eucalypti*. The specimen before me, which I take to be *metrosideri*, presents all the above-mentioned differences from *Eucalypti*. It is an extremely good, well-preserved specimen, and therefore I have no doubt that the absence of erect pilosity on the dorsal surface and the ventral segments is a valid specific character. Burmeister does not mention in comparing the species that the transverse prominence near the apex of the elytra is evidently better defined and more carina-like in *metrosideri* than in *Eucalypti*, though in the description of the former he mentions it as very conspicuous. Another character of *metrosideri* omitted by Burmeister (if

my identification of that insect is correct) consists in the fine, adpressed, scale-like, white hairs in the elytral striæ running in double rows; but this would probably be noticeable only in a very fresh specimen

S. lætus, Blanch. It is not unlikely, as Burmeister says, that his *metrosideri* is identical with this species, in which case Blanchard's name has priority; but the colouring is so entirely different, and there are so many other small discrepancies between the descriptions, that it would not be wise to drop either name without further evidence It is much to be desired that the types be compared. Blanchard says that the pronotum of *lætus* is "*dense punctatus*," while the prothoracic puncturation of *metrosideri* is only mentioned as being much more sparse than that of the clypeus. In the species regarded by me as the latter, the pronotum certainly ought not to be called "closely' punctulate. Also "*abdomine albido-piloso*" seems inconsistent with identity with *metrosideri*, of which its author expressly notes that the abdomen is devoid of erect hairs—having only short, adpressed, scale-like hairs—which is the case in the species that I believe to be *metrosideri*. Pending further evidence I therefore retain both names, and in tabulating *lætus* fall back for a distinction on the statement that its legs are green, which—if it is a good species—is not unlikely to be a valid character, as among all the many examples of *Stethaspis* before me there is not one with green legs.

S. piliger, Blanch. This is a readily identifiable species, and needs no special remarks.

S. nigrescens, Blanch., is also readily identifiable.

The following table will show characters distinctive of the known Australian *Stethaspides*, including a new species, the description of which follows the table:—

A. Legs not green.	
B. Flabellum of antennæ of male not, or scarcely, longer than the preceding joints together (colour not black).	
C. Erect hairs of pronotum at most very few and far between.	
D. Ventral segments bearing long erect hairs	Eucalypti, *Boisd.*
DD. Ventral segments devoid of long erect hairs	metrosideri, *Burm.*
CC. Pronotum with dense erect pilosity.	
D. Punctures of the inner 3 striæ of the elytra equal (colour brown)	monticola, *Blackb.*

DD Punctures of 1st and 3rd elytral striæ much smaller than of 2nd (colour of elytra green) ... . piliger, *Blanch.*

BB Flabellum of male antenna notably longer than the preceding joints together (colour black) .. nigrescens, *Blanch.*

AA. Legs green . . . . lætus, *Blanch.*

S. monticola, sp. nov. Supra pallide vel obscure brunnea, subtus nigra vix viridescens, palpis antennisque (harum flabello nonnullorum exemplorum dilutiori excepto) clypeo pedisbusque dilute vel obscure ferrugineis; tota (elytris sparsim exceptis) dense pilosa; clypeo antice parum emarginato, crebre rugulose punctulato; fronte pronotoque minus subtiliter sat crebre punctulatis; hoc quam longiori ut 20 ad 11 latiori, antice fortiter angustato, lateribus (superne visis) fere rectis (a latere visis pone medium sinuatis), basi sat fortiter bisinuata; scutello puncturis sparsis impresso; elytris paullo ante apicem transversim obtuse prominentibus, fortiter punctulato-striatis, striis pilis brevibus sat adpressis seriatim sparsim instructis; pygidio crebre subtilius ruguloso; corpore subtus subtiliter crebre (abdomine minus crebre) punctulato.

Maris antennarum flabello quam articuli ceteri conjuncti manifeste breviori, articulo 4° intus spiniformi.

Feminæ antennarum flabello quam maris, et illius articulo basali quam ceteris, multo brevioribus; antennarum articulo 4° haud spinifero. Long., 9-10 l.; lat., $5\frac{1}{2}$-$5\frac{3}{4}$ l.

A single example of this insect occurred to me on the Victorian Alps, flying in the sunshine, and recently Mr. H. J. Carter has sent me several specimens taken by him on Mount Kosciusko. The latter are all darker in colour than the former, though one of them is distinctly lighter than the other. The Victorian specimen has much more numerous short hairs in the elytral striæ than those from New South Wales; in fact, they run in regular series in all the striæ, while in those from New South Wales there are only a few here and there to be seen. My specimen was pinned and mounted at once when taken. The pilosity of all the *Stethaspides* of which I can speak from experience is so easily rubbed off that I think immediate mounting is necessary to secure specimens from abrasion. The puncturation of the pronotum is considerably stronger and closer than that of *S. Eucalypti*, Boisd.

Higher mountains of Victoria and New South Wales.

TRUE MELOLONTHIDES.

Lacordaire (whose classification I follow as closely as possible) divides the "Family" *Lamellicornes* into two "Legions," distinguished from each other by the arrangement of the abdominal stigmata—one of them exemplified plentifully in Australia by *Aphodius*, *Onthophagus*, and such like (usually known for the most part as "dung beetles"); the other of them exemplified even more plentifully in Australia by the beetles commonly called chafers." This second "Legion" is divided by Lacordaire into four "Tribes," the first of which (*Melolonthides*) has formed the subject of the Revision that I have placed before the Royal Society of South Australia during recent years, beginning with 1905, and am still continuing. Lacordaire divided the "Tribe" into nine "subtribes," five of which are known to occur in Australia. My Revision of the third of these subtribes, "Sericoides," is concluded in the preceding pages of this paper, and I now pass on to the fourth of them, which Lacordaire calls "True Melolonthides." These he divides into three "groups," only the third of which (again called "True Melolonthides," the other two being regarded as less essentially *Melolonthid*) is known to occur in Australia. It contains the non-Australian genus *Melolontha* and other genera closely allied to it. The generic synonymy of the Australian members of this "tribe" is in much confusion, and must be dealt with before I proceed to deal with the species. Australian species of the tribe have been called by the following generic names: *Melolontha* (only by the earlier authors, at the time when the name was treated as including very diverse elements, some of which are not now recognized as members even of the tribe "true *Melolonthides*"), *Rhizotrogus*, *Rhopæa*, *Holophylla*, *Lepidiota*, *Lepidoderma*, and *Neolepidiota*.

Rhizotrogus is a genus of the second of Lacordaire's "groups" of the tribe. Burmeister regarded a species which he described under the name *tasmanicus* as belonging to *Rhizotrogus*, but he recognized it as so far aberrant in that genus that he formed a separate subgenus for it under the name *Antitrogus*. I have before me a species which is almost certainly that described by Burmeister, and it is decidedly not a *Rhizotrogus*, but a member of the group "true *Melolonthides*." *Antitrogus*, therefore, must be transferred to the tribe "true *Melolonthides*," while *Rhizotrogus* must drop out of the Catalogue of Australian *Coleoptera*. The names *Rhopæa* and *Holophylla* were proposed by Erichson (Ins. Deutschl., vol. iii., 1848) for Australian insects, which, however, their author did not name or describe as species The former was placed by its author

among the true *Melolonthides*, the latter in a group which was separated by him under the name *Tanyproctini*. Comparing the very brief diagnoses of the genera one finds that they are distinguished from each other by the number of joints (six and seven) in the antennal flabellum and by the presence in *Holophylla* (but not in *Rhopæa*) of complete ventral sutures. The former of these characters is of no value at all; its acceptance would involve breaking up *Rhopæa* into five genera, in which the species most closely allied would be generically separated Burmeister in 1855 stated that *Holophylla* has not complete ventral sutures—a statement that no doubt is correct in respect of the insect which he (Burmeister) regarded as *Holophylla* and named *H. furfuracea*—and that it is one of the true *Melolonthides*. But he does not appear to have had good authority for his identification. His remarks are too long to be quoted at full length here, but they imply his not having before him the actual specimen on which Erichson founded his genus; moreover, if he had had that specimen before him it seems most unlikely that he would not have described it and given it a specific name as being Erichson's type. At the time Burmeister wrote there was no Australian species known (apart from the undescribed species called *Holophylla*) of *Melolonthides* having transverse front coxæ and complete ventral sutures, and therefore a mistake on Erichson's part appeared the less unlikely, but since that time a genus has been described by Olliff (*Othnonius*) on a single species (*O. Batesi*) of which I have examples before me, and which undoubtedly falls (in Erichson's classification) in the *Tanyproctini* where he placed *Holophylla*—it having transverse front coxæ and complete ventral sutures, and might very well be the species that Erichson called *Holophylla* were it not for the generically valueless difference that its antennal flabellum has only six joints. It seems so unlikely that an author of Erichson's ability and reputation would definitely place a *Melolonthid* among those having complete ventral sutures (a very easily observed character), when that was not the case with it, as to suggest the probability of Burmeister's having been incorrect in his conjecture that the species he described as *Holophylla* is congeneric with Erichson's *Holophylla*, and the probability of the insect for which Erichson founded that genus being generically identical with, or very near to, that for which Olliff at a later date proposed the name *Othnonius*. To this must be added a very serious discrepancy between Erichson's and Burmeister's descriptions of the claws of *Holophylla*. Erichson says of them that they have "a single tooth at the base," distinguishing them from those of genera

whose claws have two teeth. Burmeister says of *Holophylla* that its claws are "*fein mit kleinem spitzen Zahn vor der Mitte und zahnartig vortretender Basis.*" Is it to be supposed that Erichson wrongly observed both the claws and the ventral sutures? The conclusion seems inevitable that Burmeister's *Holophylla* is a genus of the "Groupe" "true *Melonontides*" and is closely allied to *Rhopæa*, while Erichson's *Holophylla* belongs to the "Groupe" *Macrophyllides* (treated by Erichson as part of his "Tanyproctini") and is allied to, and possibly identical with, Olliff's genus *Othnonius*. As Burmeister's is the later use of the name, I propose the new name *Pseudholophylla* for his *Holophylla*.

I am sorry that I was myself in error in a former paper in accepting Burmeister's conclusions regarding *Holophylla*, for I described as doubtfully of that genus a species ("*australis*," Trans Roy Soc , S A., 1887, p. 211) which I then regarded as probably congeneric with Burmeister's *H. furfuracea*. At the same time I drew attention to the extreme closeness of *Rhopæa* and Burmeister's *Holophylla*. As a result of studying Brenske's memoir (discussed later on in this paper) I have, however, subsequently satisfied myself that my *H australis* is not truly congeneric with *H. furfuracea*, Burm., but must be referred to *Rhopæa*, to which *Pseudholophylla* (as I now call Burmeister's genus) is certainly extraordinarily close. The difference in the palpi which I referred to (*l.c.*) as separating my *R. (Holophylla) australis* from *Rhopæa* ceases to appear generic when a considerable number of species of *Rhopæa* are compared with each other.

Turning now to Burmeister's lengthy diagnosis of his genus *Holophylla*, its author does not point out its differences from *Rhopæa*, omitting it from his tabulation of generic characters, and in comparing the diagnosis, character by character, with that furnished by him of *Rhopæa* I should be disposed to think that the two might well be founded on different species of *Rhopæa* were it not for the one statement that the apical spurs of the posterior tibiæ in *Holophylla* are "somewhat blunt and at the apex leather-like." This last phrase is not very clear, but I take it to refer to the somewhat transparent ("parchment-like" I should prefer to call it) appearance of the apical part of the spurs of the hind tibiæ in those genera of the true *Melolonthides* which have the spurs blunt and dilated. The importance of this character will be found discussed later on in this paper; it will suffice here to say that it appears to be in itself a valid generic distinction between *Pseudholophylla* and *Rhopæa*. I have recently acquired a *Melolonthid* species occurring in

Queensland, which appears to be certainly congeneric and very probably conspecific, with that which Burmeister described as *H. furfuracea*. It agrees perfectly with the generic characters assigned (especially in respect of the large strongly convex eyes) with the qualification that the apex of the 3rd antennal joint can scarcely be called 'strongly'' produced in a point (certainly not a valid generic difference, however), and that I have not dissected and examined the inner mouth organs Burmeister's specific description is undesirably brief, but my specimen agrees with it such as it is except in respect of the statement that the front tibiæ are without spurs. In my specimen the spurs in question are extremely short (much more so than in most species of *Rhopæa)*, but they are not absolutely wanting. The spurs of the hind tibiæ furnish, I think, the decisive difference from *Rhopæa*, but it may be noted that the tooth of the claws is much further from the base than in *Rhopæa* (as is indicated in Burmeister's diagnoses of those genera).

The subdivision of Lacordaire's "Groupe" "true *Melolonthides*" is most perplexing, owing to the difficulty of finding well-marked characters that are, on the one hand, constant in aggregates of species evidently closely related *inter se*, and, on the other hand, constantly wanting in other such aggregates In Berliner Entomolog Zeitschrift , 1892, Herr Brenske discussed the classification of Lacordaire's "subtribe" "True *Melolonthides*" without limiting his remarks to the genera of any particular country The portion of his memoir which refers to the "Groupe" "True *Melolonthides*" is, of course, the only portion that concerns genera known to be Australian. It is difficult to ascertain exactly how he would treat some of our genera because he referred only incidentally to the characters of some of them, the definite objective of his memoir being the discussion of an aggregate in which he mentioned only one of our Australian genera. It seems fairly clear, however, that his classification would not fit our Australian genera. All of them apparently would have to be divided between two aggregates, which he calls *Polyphyllides* and *Leucopholides*, distinguished from each other by the length of the third antennal joint. The typical species of *Rhopæa (R. Verreauxi*, Blanch.) falls into the former of these aggregates on account of the elongation of its third antennal joint, but the length of the third joint varies extremely among species which certainly ought not to be separated generically (and still less, placed in different *groups* of genera): in *R. morbillosa*, Blackb., for example, the 3rd joint being shorter in proportion to the 4th than it is in some species that obviously pertain to *Lepidiota*, which

Brenske places in the other aggregate. It, therefore, appears to me impossible to divide the Australian true *Melolonthides* into groups distinguished by the length of the 3rd antennal joint without arriving at a result that would be absolutely ludicrous.

Among the characters which Brenske attributes to his aggregate *Leucopholides* there is one which, although he does not definitely state that it distinguishes those species from the *Polyphyllides*, nevertheless does appear to be of considerable value in separating the Australian genera of true *Melolonthides* into two aggregates. That character lies in the apical spurs of the hind tibiæ, which in Brenske's group *Leucopholides* are (or at any rate one of them is) greatly dilated in the females as compared with those of the other sex. Brenske does not characterize the spurs in the *Polyphyllides* having, when he reaches that stage in his paper where the spurs come in, already dismissed that aggregate as having the 3rd antennal joint elongate, and mentions only the *Rhizotrogides* (an aggregate not known to be Australian) as having the spurs alike in the two sexes. But, with some little hesitation, I think that character may serve as important for classifying the Australian genera of Lacordaire's "Groupe" "true *Melolonthides*."

Before explaining my use of the qualification "with some hesitation" it is necessary to refer to another character not mentioned by Brenske in the paper I am discussing, but which my studies of the Australian *Melolonthides* have led me to consider highly important from the generic point of view, though my knowledge of *Melolonthides* of other countries than Australia is not sufficient to qualify me for estimating its value in respect of other than Australian genera. The character that I refer to is the form and sculpture of the declivous front face of the clypeus. In the species of *Rhopæa* (*i.e.*, of those species which one cannot doubt must be associated more or less closely with *R. Verreauxi*, Blanch.) the declivous front face of the clypeus is perpendicular or almost so, very high on the vertical line (the distance from base to summit being about equal to the length of the apical joint of a maxillary palpus), somewhat strongly and narrowly emarginate in the middle of its lower margin to receive the labrum, and having its whole surface (except a more or less narrow band along the summit) strongly and equally rugulose and set with long soft hairs. In *Lepidiota* and *Lepidoderma* the declivous front face of the clypeus is much less high (the distance from base to summit being much less than the length of the apical joint of a maxillary palpus), widely and feebly emarginate on its lower margin, and having

its surface (never as in *Rhopæa Verreauxi* but) rugulose and pilose only on the lateral parts (or with such sculpture extending across the middle only as a row of setigerous punctures).

Now in female *Rhopæa* (at any rate in the five species of which I have seen a female) the spurs of the hind tibiæ are of the same shape as in the male and are not (or scarcely) more dilated, the external sexual characters being in the antennæ and the hind tarsi, so that if the three genera I have already named were all that had to be reckoned with it would not be of practical importance to decide whether the clypeal or tibial generic structure should be regarded as the primary character for classification. But there are species which cannot be referred to any of those genera. There is *Antitrogus*, with the clypeus of a *Rhopæa* and spurs of hind tibiæ distinctly tending towards the *Lepidiota* type.

Next there is the insect which I described as *Rhopæa callabonensis*, but which on account of the structure of its labrum I do not now think can be included in *Rhopæa* or any other genus known to be Australian; it has the clypeus and antennæ of a *Rhopæa* and (although it is a male) the tibial spurs of a female *Lepidiota*. *Pseudholophylla* has head and antennæ exaggeratedly of the *Rhopæa* type, but again (though a male) tibial spurs that would befit a female *Lepidiota*. Another species before me has clypeus and tibial spurs like a *Lepidiota*, but antennæ of a *Rhopæa* (male with elongate 3rd joint and flabellum of 6 long joints). *Neolepidiota* in respect of clypeus, antennæ, and tibial spurs agrees (if it is a male) with *Lepidiota*.

The conclusion I have reached on full consideration of the data supplied above, and giving much weight to the practical inconvenience of a classification which is inoperative in species whose females are not known, is that for the Australian species of Lacordaire's "Groupe" "true *Melolonthides*" the best character for dividing them primarily into two aggregates is to be found in the structure of the clypeus. This classification brings together into one aggregate *Rhopæa*, *Pseudholophylla*, *Antitrogus*, and a genus characterized in the following pages as *Pararhopæa*, and places together in a second aggregate *Lepidoderma*, *Lepidiota*, *Neolepidiota*, and a genus characterized in the following pages as *Paralepidiota*. The former of these primary aggregates is no doubt capable of satisfactory subdivision founded on the spurs of the hind tibiæ, but in the absence of definite certainty as to the female of *Antitrogus* it would be unwise to make use of that character, and I therefore in both aggre-

gates found their subdivision on the presence *(a)* of three joints only, *(b)* of more than three joints, in the antennal flabellum, which seems to be a more important character in this group than it is in the *Sericoides*.

It may be noted here that *Rhopæa* is extremely close to the Fabrician genus *Melolontha*. Lacordaire distinguishes it from the latter by there being an additional lamina in its antennal flabellum (which is certainly not a valid generic character), and adds that it is of more cylindric and parallel form, that its pygidium is slightly emarginate in the female (in *Melolontha* he calls the hind margin of the pygidium "of variable form"), and that it has no trace of a mesosternal process (in tabulating *Melolontha* he places it in the aggregate "no mesosternal process," but in the diagnosis of the genus says that its mesosternum is "slightly prominent"). I have before me *M. vulgaris*, Fab , which is, I believe, the typical species of the genus, and fail to discover in it any mesosternal process on which to found a generic distinction. Its extraordinarily produced pygidium is totally different from the pygidium of any known *Rhopæa*, but Lacordaire states that that elongation is wanting in some other European members of the genus. In fact, the only character that I can find (likely to be generic) constant in *Rhopæa* distinguishing it from *M. vulgaris* (now before me) and from the constant characters of *Melolontha* as stated by Lacordaire is in the claws, their tooth being in *Rhopæa* much larger and placed at a considerably greater distance from the base of the claw than in *Melolontha*.

I may now pass on to show in tabular form distinctive characters for those aggregates of the "Groupe" "true *Melolonthides*" which in my opinion should be regarded as valid genera, so far as concerns the Australian Fauna. I am doubtful, however, whether the species that I attribute to *Lepidiota* ought not to be divided into more than one genus; but since *Lepidiota* is of very wide distribution, and Australia does not appear to be its headquarters, a wider knowledge than I possess of the species occurring outside Australia should be at the disposal of an author to enable him to deal satisfactorily with that question.

A. Front face of clypeus rugulose, and set all across with long soft hairs; distance from its base to its summit about equal to the length of the apical joint of a maxillary palpus.
  B. Antennal flabellum consisting of more than 3 joints.
    C. Labrum vertical or nearly so.

D. Apical spurs of hind tibiæ in both sexes elongate and pointed, not dilated to middle	Rhopæa.
DD. Apical spurs of hind tibiæ (in ♂ and no doubt still more so in ♀) comparatively short and blunt, dilated from base to middle	Pseudholophylla.
CC. Labrum strongly directed forward, almost horizontal .	Pararhopæa.
BB. Antennal flabellum consisting of only 3 joints	Antitrogus.
AA. Front face of clypeus in middle part not "rugulose and evenly set with long hairs"; distance from its base to its summit much less than in A.	
B. Antennal flabellum consisting of more than 3 joints.	
C. Laminæ of the antennal flabellum as long as the preceding joints together	Paralepidiota.
CC. Laminæ of the antennal flabellum much shorter	Lepidoderma.
BB. Antennal flabellum consisting of only 3 joints.	
C Front tarsi very long	Neolepidiota.
CC. Front tarsi much shorter	Lepidiota.

RHOPÆA.

So little has been reported of the Fauna of some parts of Australia that it is unsafe to generalize very positively regarding the geographical distribution of genera, but subject to that qualification it may be said that *Rhopæa* is chiefly a Southern Australia genus. I have no evidence of its occurrence further north than the Brisbane district except the possession of a single specimen labelled "N. Queensland." Neither have I seen any *Rhopæa* from any locality west of Yorke Peninsula. The genus seems to have its headquarters about the latitude of Sydney. Female *Rhopæa* are very much rarer in collections than males. Of the species of which I have seen the largest number of specimens (*R. magnicornis*) I have not seen a female, and the case is similar in respect of more than half of the other species. The antennal flabellum and the tarsi of the males are longer (generally very much longer) than those of the other sex. I have in my collection a female *Rhopæa* from New South Wales (not, I think, conspecific with any male known to me) with the extraordinary character of its antennæ consisting of only 9 joints. That number seems so improbable that I have examined the specimen over and over again thinking that I must have made some mistake, but always with the same conclusion—only 9 joints. Joint 3 is very elongate, 5

shortly spinose on its inner side, 6 a very short lamella, 7-9 fairly elongate lamellæ, each a little longer than joints 3-5 together. I can regard this structure only as a freak, either in the individual or the species, unfitting it for description without examination of more specimens. *Rhopæa castaneipennis*, Macl. (from North-West Australia) is incorrectly placed in this genus, and I think it will require a new generic name. There are two specimens (one of which is labelled "type") which I have inspected in the Macleay Museum; but as I had not available for comparison examples of the two new genera near *Rhopæa* that are diagnosed in the following pages I do not venture to deal with it at present. The structure of its labrum associates it with *Pararhopæa*, but the spurs of its hind tibiæ are of the *Rhopæa* type and the sculpture of the front face of its clypeus is notably less rugulose (with much shorter and coarser pilosity) than in *Rhopæa* and *Pararhopæa*, but nevertheless is distinctly of the *Rhopæa* rather than the *Lepidiota* type. It is clearly a very isolated form in the *Melolonthides*, and its habitat is very remote from any from which known species near *Rhopæa* have been reported, but probably the future will bring to light other species from the same region congeneric with it.

The following table indicates characters by which the males of the known species of *Rhopæa* can be distinguished: —

A. Antennal flabellum consists of 8 laminæ (7 of about equal length) .	magnicornis, *Blackb.*
AA. Antennal flabellum consists of 7 laminæ (at least 6 of them long and subequal).	
B. Punctures of pronotum very close throughout; for the most part confluent.	
C. Joint 3 of antennæ not longer than its width at the apex.	
D. Elytra, and dorsal surface of pronotum, having only close short pubescence.	
E. Prothorax very strongly narrowed in front, and with sides very strongly rounded	soror, *Blackb.*
EE. Prothorax not strongly narrowed in front, and with sides (viewed from above) lightly arched	heterodactyla, *Germ.*
DD. Elytra and whole surface of pronotum sparsely set with erect comparatively long hairs	hirtuosa, *Blackb.*
CC. Joint 3 of antennæ much more than twice as long as wide ...	assimilis, *Blackb.*

BB. Punctures of pronotum subconfluent on sides but distinctly spaced on disc, some intervals larger than the adjacent punctures.
C. Width of prothorax considerably less than twice length.
D. Disc of pronotum quite sparsely punctulate ... . australis (*Holophylla*), [*Blackb.*
DD. Disc of pronotum closely (though by no means confluently) punctulate .. .. pilosa, *Blackb.*
CC Width of prothorax fully twice the length of same ... ... laticollis, *Blackb.*
AAA. Antennal flabellum consists of 6 laminæ (1st of them usually very short).
B. Punctures of pronotum confluent and very small ... ... Verreauxi, *Blanch.*
BB. Punctures of pronotum very much larger and less close.
C. Sides of prothorax distinctly angulate about the middle of their length .. .. dubitans, *Blackb.*
CC. Sides of prothorax only rounded about the middle of their length.
D. Joint 3 of antennæ very short, scarcely longer than wide .. Mussoni, *Blackb.*
DD. Joint 3 of antennæ considerably longer than wide.
E. Joint 3 of antennæ abruptly rounded on inner side just before apex; body long and parallel .. .. consanguinea, *Blackb.*
EE. Joint 3 of antennæ cylindric; body much wider and less parallel ... ... rugulosa, *Blackb.*
AAAA. Antennal club consists of 5 laminæ (only apical 3 of them full length).
B. Front margin of clypeus widely upturned; pygidium very closely asperate without other punctures.
C. Sides of prothorax evenly and not very strongly rounded .. .. incognita, *Blackb.*
CC. Sides of prothorax abruptly, and very strongly, rotundate-dilatate about middle .. .. morbillosa, *Blackb.*
BB. Front margin of clypeus only very narrowly upturned; pygidium coriaceous and studded with much larger punctures ... ... planiceps, *Blackb.*

Table of characters distinguishing the female *Rhopææ* known to me:—

A. Puncturation of pronotum very close and fine (as in their males).
B. Antennal flabellum with 6 long and subequal laminæ ... ... soror, *Blackb.*

BB. Antennal flabellum with only 5 long and subequal laminæ ... . Verreauxi, *Blanch.*

AA. Punctures of pronotum much larger and less close (as in their males).

B. Antennal flabellum with 5 subequal laminæ, each equal to joints 1–5 of the antennæ together . . Mussoni, *Blackb.*

BB. Antennal flabellum with only 3 of its laminæ subequal, each of them much shorter than in *Mussoni* ... rugulosa, *Blackb.*

R. assimilis, sp. nov., Mas. Elongata; subtiliter pubescens, capite prothoracis margine antico sternis pedibusque pilis elongatis vestitis; rufo-brunnea, capite pronoto scutello pygidioque confertissime subtilissime nonnihil aspere (clypeo fortiter transverso, antice sat alte reflexo, minus crebre minus subtiliter) punctulatis; elytris dupliciter (subtiliter fere ut pronotum, et puncturis majoribus numerosis leviter impressis) punctulatis; palporum maxillarium articulo apicali supra profunde concavo; antennis 10-articulatis, articulo 3^{o} quam 1^{us} 2^{us} que conjuncti nonnihil longiori, flabello 7-articulato quam articuli ceteri conjuncti paullo longiori (illius articulo basali quam ceteri multo breviori); prothorace quam longiori ut 5 ad 3 latiori, antice sat fortiter angustato, lateribus crenulatis parum arcuatis, basi late leviter lobata angulis posticis obtusis; pygidio ad apicem anguste obsolete emarginato.

Fem. latet. Long., 11 l.; lat., 5 l. (vix.).

Easily distinguishable from its known congeners by its close fine puncturation (not much different from that of *R. Verreauxi*, Blanch., except in the puncturation of the pygidium being manifestly less close and fine) in combination with a 7-jointed antennal flabellum, the first joint of which is less than half as long as the second joint. It differs from all the other known species having very fine and close puncturation (except *Verreauxi*) by the elongate 3rd joint of its antennæ, and from all of them except *heterodactyla*, Germ., by the much less strongly arched sides of its prothorax, which when viewed from above appear almost evenly narrowed from base to apex—though viewed from the side they are seen to be quite strongly—but notably less strongly than in others except *heterodactyla*—rounded. The 3rd joint of the antennæ joins on to the flabellum much nearer to the hind extremity of the latter than in *heterodactyla*, *soror*, and *hirtuosa*.

New South Wales; sent to me by Mr. Sloane, as taken at Bulli.

R. pilosa, sp. nov., Mas. Minus elongata; subtiliter pubescens, capite pronoto elytrisque pilis erectis fulvis sat elongatis vestitis, sternis pedibusque longe fulvo-

pilosis; rufobrunnea: capite crebre sat fortiter (clypeo magis grosse, hoc sat transverso antice sat alte reflexo) punctulato: palporum maxillarium articulo apicali supra concavo; antennis 10-articulatis, articulo 3o triangulari (intus quam articuli 1us 2us que conjuncti vix breviori, extus multo breviori, margine apicali ad flabellum applicato quam margo anticus sat longiori, cum hoc angulum plus minusve spiniformem efficienti), flabello 7-articulato quam articuli ceteri conjuncti sat longiori (illius articulo basali quam ceteri parum breviori); prothorace quam longiori ut 18 ad 11 latiori, antice sat angustato, supra inæqualiter (puncturis non nullis quam ceteræ multo majoribus) sat crebre sat fortiter punctulato, lateribus crenulatis fortiter rotundatis, basi bisinuata, angulis posticis obtusis; elytris longitudinaliter obtuse obsolete costulatis, dupliciter (subtiliter, et puncturis majoribus numerosis leviter impressis) punctulatis; pygidio confertissime subtilissime nonnihil aspere punctulato.

Fem. latet. Long., $9\frac{1}{2}$ l.; lat., $4\frac{4}{5}$ l.

Somewhat closely allied to *R. (Holophylla) australis*, Blackb., but much less nitid, the sides of the prothorax more strongly rounded, the puncturation of the pronotum (especially of its disc) much closer and stronger. From *R. assimilis*, Blackb., it differs by, *inter alia*, the triangular shape of its 3rd antennal joint, from *heterodactyla*, *soror*, and *hirtuosa* by the very much less close puncturation of its pronotum, and from the rest of its known congeners by the number of joints in the flabellum of its antennæ. The peculiar form of the 3rd joint of the antennæ, as described above—that joint, moreover, meeting the flabellum considerably in front of the hind margin of the latter—is a structure common to all the *Rhopæa* known to me (except *assimilis*), having the flabellum of 7 joints. The erect pilosity of the dorsal surface of this species also distinguishes it from *heterodactyla*, *soror*, and *assimilis*.

New South Wales: sent by Mr. Froggatt, as from Boro (his No. 17).

R. laticollis, sp. nov., Mas. Minus elongata; subtiliter pubescens, capite pronoto elytrisque pilis erectis fulvis sat elongatis vestitis, sternis pedibusque longe fulvo-pilosis; rufobrunnea; clypeo (hoc minus transverso, antice alte reflexo) sat grosse nec rugulose, fronte confertim subtiliter aspere, punctulatis; palporum maxillarium articulo apicali supra depresso, parte depressa coriacea; antennis 10-articulatis, ut præcedentis (*R.*

pilosæ) formatis; prothorace quam longiori duplo latiori, antice parum angustato, supra crebre (in disco nullo modo confluenter) punctulato, lateribus crenulatis fortiter rotundatis, angulis posticis obtusis, basi in media parte manifeste lobata; elytris longitudinaliter obtuse sat perspicue costulatis, dupliciter (minus fortiter et puncturis majoribus numerosis sat fortiter impressis) punctulatis; pygidio puncturis minus crebre minus fortiter impresso.

Fem. latet. Long., 10 l.; lat., 5 l.

Differs from all the other species of *Rhopæa* known to me (except *pilosa)* by the characters cited above as distinguishing *R. pilosa* from them. It differs from all of them (including *pilosa)* by its prothorax fully twice as wide as long, and also by the sculpture of its elytra, the punctures of which are all strongly impressed—the smaller ones not nearly so small or closely placed as in other species *(e.g., pilosa)*—a sculpture which causes the elytra to be distinctly rugulose and somewhat more nitid than is usual in many *Rhophææ*. The coriaceous space on the dorsal surface of the apical joint of the maxillary palpi is not, as it is in many *Rhopæa (e.g.,* the two described above), concave, but is merely depressed; I am, however, doubtful of the value of this character, as the depth of the concavity is certainly not quite invariable within the limits of a species.

New South Wales, Inverell: sent to me by Mr. Carter.

R. dubitans, sp. nov., Mas. Minus elongata; capite pronoto elytrisque pilis erectis fulvis sat elongatis sparsim vestitis, sternis pedibusque longe pilosis; rufo-brunnea; clypeo (hoc minus transverso peralte reflexo) sat crebre sat fortiter nec rugulose, fronte fere ut clypeus sed rugulose, punctulatis; palporum maxillarium articulo apicali supra concavo, parte concava coriacea; antennis 10-articulatis, articulo 3° quam latiori circiter duplo longiori, flabello 6-articulato quam articuli ceteri conjuncti parum longiori (illius articulo primo quam ceteri fere triplo breviori); prothorace quam longiori ut 18 ad 11 latiori, antice fortiter angustato, supra sparsius minus profunde (latera basinque versus crebrius profundius) punctulato, lateribus crenulatis fortiter (in media parte obtuse subangulatim) rotundatis, angulis posticis rectis, basi media late leviter lobata; elytris longitudinaliter obtuse sat obsolete costulatis, fortiter inæqualiter rugulose sat crebre punctulatis; pygidio crebre subtiliter subaspere punctulato.

Fem. latet. Long., 10 l.; lat., 4$\frac{4}{5}$ l.

Somewhat close to *R. Mussoni*, Blackb., but easily distinguishable by the much longer joint 3 of its antennæ, the manifestly sparser and feebler puncturation of its pronotum, and the evident angularity of the latero-median dilatation of its prothorax.

New South Wales (exact locality not known).

R. rugulosa, sp nov. Sat lata; supra subglabra, sternis pedibusque longe fulvo-pilosis; rufo-brunnea; capite pronotoque sat fortiter vix crebre vix rugulose punctulatis; clypeo minus transverso peralte reflexo; palporum maxillarium articulo apicali supra concavo, parte concava coriacea; antennis 10-articulatis; prothorace quam longiori ut 5 ad 3 latiori, antice sat angustato, lateribus crenulatis sat fortiter nec angulatim rotundatis, angulis posticis rectis, basi bisinuata; elytris longitudinaliter obtuse sat obsolete costulatis, rugulose subgrosse vix crebre punctulatis; pygidio coriaceo, leviter minus confertim subtilius punctulato.

Maris antennarum articulo 3° quam latiori multo longiori sat cylindrico, flabello quam articuli ceteri conjuncti sat longiori 6-articulato (illius articulo primo quam ceteri tribus partibus breviori).

Feminæ antennarum flabello quam articuli ceteri conjuncti multo breviori, 6-articulato (illius articulis primo perbrevi, 2° 3° 4° gradatim longioribus, 5° 6° que 4° æqualibus); tarsis quam maris multo brevioribus Long., 11 l.; lat., $5\frac{1}{5}$ l.

Nearest to *R. dubitans*, but at once distinguishable from it by the evidently closer puncturation of its pronotum, the punctures of its pygidium much less close and much larger, and the sides of its prothorax evenly (without any angularity) rounded in the middle. There is no pilosity on the dorsal surface of either of the specimens before me, and this does not appear to be the result of abrasion.

Queensland, Brisbane; given to me by Mr. French.

R. consanguinea, sp. nov., Mas. Præcedenti (*R. rugulosæ*) affinis; multo magis angusta; antennarum articulo 3° breviori, quam latiori haud multo longiori, ad apicem quam ad basin multo latiori, ante apicem intus manifeste anguliformi; antennarum flabelli articulo 1° paullo longiori; prothorace antice magis angustata, ad basin manifeste lobato; elytrorum costulis multo minus obsoletis.

Fem. latet. Long., $10\frac{1}{2}$ l.; lat., 5 l. (vix.).

Subject to the qualifications mentioned above the description of *R. rugulosa* applies to this species, and need

not be repeated at full length; the puncturation of the two presents no noteworthy distinction. The notably narrower more parallel and more elongate form is, I think, a reliable character in *Rhopæa;* the difference in the shape of the prothorax is very noticeable when the two species are side by side, and the very different structure of the 3rd antennal joint prevents any difficulty in distinguishing either from the other. In all probability these characters are distinctive of the females also. The greater development of the elytral costæ in the unique type of *R. consanguinea* is perhaps not so reliable as the other characters cited.

North Queensland.

R. incognita, sp. nov. Mas. Modice elongata; rufotestacea; fronte elytrisque pilis erectis fulvis sparsim vestitis, sternis pedibusque longe fulvo-pilosis; clypeo crebre rugulose subtilius punctulato, antice alte reflexo; fronte subgrosse rugulosa; exempli typici palpis maxillaribus carentibus; antennis 10-articulatis, articulis 3º sat brevi quam latiori parum longiori 5º brevi intus breviter spiniformi, flabello 5-articulato (articulis 1º quam 2us dimidio, 2º quam 3us fere dimidio, brevioribus) quam articuli ceteri conjuncti sat longiori; prothorace quam longiori ut 10 ad 6½ latiori, antice fortiter angustato, sat crebre sat fortiter punctulato, lateribus crenulatis minus fortiter rotundatis, angulis posticis acute rectis, basi sat fortiter lobata; elytris longitudinaliter obtuse minus obsolete costulatis, rugulose subgrosse vix crebre punctulatis; pygidio subtillisime creberrime punctulato.

Fem. latet. Long., 11½ l.; lat., 5½ l.

This species is near *R. morbillosa*, Blackb., but of narrower form, its antennæ similar, its clypeus a little less strongly elevated in front, its prothorax more strongly narrowed in front and having sides much less dilatate in the middle and base more lobate, its pygidium more finely and more closely punctulate. From *R. planiceps* it differs by, *inter alia*, its clypeus very much more strongly reflexed, its prothorax more strongly narrowed in front and more strongly lobed at base and its pygidium much more closely and finely punctulate. From both the above it differs by the much better defined *costulæ* of its elytra.

Australia (locality uncertain, but I believe I took it in the Victorian Alpine Region).

R. planiceps, sp. nov., Mas. Minus elongata; supra subglabra, sternis pedibusque longe fulvo-pilosis; rufobrunnea; capite pronotoque sat fortiter vix crebre punctulatis; clypeo minus lato, antice parum reflexo;

palporum maxillarium articulo apicali supra concavo, parte concava coriacea; antennis 10-articulatis, articulis 3o sat cylindrico quam latiori sat multo longiori 5o brevi intus breviter spiniformi, flabello 5-articulato (articulis 1o quam 3us dimidio breviori, 2o quam 1us paullo longiori) articulis ceteris conjunctis longitudine sat æquali; prothorace quam longiori ut 18 ad 11 latiori, antice sat angustato, lateribus crenulatis minus fortiter rotundatis, angulis posticis rectis, basi manifeste lobata; elytris longitudinaliter obtuse sat obsolete costulatis, rugulose subgrosse vix crebre punctulatis; pygidio coriaceo, leviter minus crebre subtilius punctulato

Fem. latet. Long., 10 l.; lat., $4\frac{4}{5}$ l.

This species resembles *R. rugulosa*, Blackb., in respect of puncturation, but is easily distinguishable by, *inter alia*, the front of its clypeus only very lightly upturned, its antennal flabellum with only 5 joints, and the sides of its prothorax much less strongly rounded. The number of joints in its antennal flabellum distinguishes it from all the other known species of the genus except *R. morbillosa*, Blackb, and *incognita*, Blackb.

South Australia; type in South Australian Museum.

PSEUDHOLOPHYLLA (gen. nov. *Melolonthidarum verarum*, Lac.).

This is a new name for *Holophylla*, Burm. (*nec* Er.). Only one species (*furfuracea*, Burm.) has been described. The insect which I believe to be that species occurs in Queensland.

PARALEPIDIOTA (gen. nov. *Melolonthidarum verarum*, Lac.).

A. Lepidiota differt antennarum flabello laminas plures quam tres præbenti. *A. Lepidodermate* differt mas tibiarum posticarum spina interna ad mediam partem quam ad basin multo latiori, et antennarum flabello quam articuli præcedentes conjuncti longiori.

I place this genus near *Lepidiota* rather than *Rhopæa*, on account of the structure of its clypeus, the erect front face of which is not strongly elevated above the labrum (much less than the length of the apical joint of the maxillary palpi) and is very nitid, and bears very large punctures, which emit short, coarse, white hairs and scales. It differs from all the other known Australian genera of the *Lepidiota* group by its antennæ, which are like those of a *Rhopæa* (6 long laminæ in

the male flabellum of the species before me). It is also notable in respect of the inner spur of its hind tibiæ, which is dilated from its base in the male to beyond the middle of its length (and then suddenly narrowed almost to a point) and in the female quite to its rounded apex.

I must defer the description of this insect as a species until my next paper, as a memoir by Herr Brenske describing new species of *Lepidoderma* (among which it is just possible that this species is included) will not reach me until too late to be studied before the issue of my present paper, but it seemed desirable to place the genus in the preceding tabulation.

PARARHOPÆA (gen. nov. *Melolonthidarum verarum*, Lac.).

Rhopææ affinis Mentum transversum; palpi labiales minus breves, articulo apicali oblongo ad apicem acuminato; palpi maxillares sat elongati, articulo apicali supra concavo; labrum sat magnum fere horizontale, antice profunde emarginatum; clypeus modicus, declivitate antica alta verticali æqualiter rugulosa et pilis sat elongatis obsita; antennæ 10-articulatæ, flabello maris valde elongato (hujus laminæ quam tres sunt plures); pedes sat elongati, tibiis anticis intus ad apicem spina brevi armatis extus dentatis, tibiis posticis maris ad apicem calcaribus 2 armatis (horum altero brevi spiniformi altero elongato laminiformi a basi ad mediam partem leviter dilatato), unguiculis pone medium dente valido armatis ad basin vix dentiformibus.

Femina latet.

Ad hoc genus tribuenda est *P. (Rhopæa) cullabonensis*, Blackb.

This species has been sufficiently described in Trans. Roy. Soc., S.A., 1894, p. 205. It should perhaps be added that its front tibiæ have three external teeth. It differs from *Rhopæa* principally by the form of its labrum, by the more elongate and slender apical joint of its labial palpi, and by the spurs of its hind tibiæ.

ANTITROGUS.

All the specimens that I have seen of this genus are from the south-eastern quarter of Australia and from Tasmania. Examples, especially of the female, are not common in collections, but this is due probably (at any rate in respect of the males) to accidental circumstances, or perhaps to periodicity, as males of one of the species known to me were

found plentifully by Mr. Griffith flying in the evening at Henley Beach, near Adelaide. The *Antitrogi* are comparatively large *Melolonthides*, not closely resembling in facies any others known to me, but perhaps most like the less elongate species of *Rhopæa*, which indeed are, in my opinion, their closest allies. Brenske regarded them as a subgenus of *Lepidiota*, but in this I cannot follow him. I cannot find any statement of his reasons for this assignment but conjecture that it was founded on the number of joints in the antennal flabellum (to which I am convinced he attributed too much importance) and on the structure of the spurs of the hind tibiæ in the female. This latter character is no doubt of importance, but I doubt whether Brenske can have seen a female, which sex was not known to Burmeister, the author of the genus and of its only as yet described species; and as Brenske refers only to that species, and refers only to Burmeister's treatment of that species (which was certainly founded on a male), it seems quite possible that he had seen only the original type. As a fact the structure of the spurs of the hind tibiæ in the female is much more of the *Rhopæa* type than of the *Lepidiota* type. The inner spur of that sex is a little more definitely enlarged as compared with that of the male than in *Rhopæa*, and is blunted at the apex (probably indicating that the place of *Antitrogus* is between *Rhopæa* and *Lepidiota*), but it has no tendency towards the "spoon" shape which Brenske considers (so far as my knowledge of the genus extends, correctly) characteristic of *Lepidiota*, and, moreover, is not dilated from the base upward. The sculpture and vestiture of the front declivous face of the clypeus is absolutely of the *Rhopæa* type, a character which—as I have already indicated—I regard as of first importance. When to these considerations are added the fact that *Antitrogus* in facies considerably resembles *Rhopæa* and is particularly unlike a typical *Lepidiota*, and the fact that its vestiture (at any rate that of all the species I have seen) is entirely pilose (not squamiferous), it really seems to me a very clear case that Brenske misplaced it.

Burmeister made *Antitrogus* a subgenus of *Rhizotrogus*, and, of course, Brenske is right in disputing that assignment. It is no doubt very much nearer *Lepidiota* than *Rhizotrogus*.

The three species known to me of the genus are extremely close, *inter se*, and seem to be very variable in colour and in degree of pruinosity. I find, however, very little variation among the individuals of the only large batch of specimens that I have seen as taken in company, and therefore I think that the differences of colour and iridescence in the single individuals (or in some cases two) that I have seen

from other localities and in which I cannot find good structural specific differences, may possibly be found when more specimens of both sexes can be examined to be accompanied by distinctions of specific value.

The sexual differences in *Antitrogus* are not very conspicuous except in respect of the laminæ of the antennal flabellum, which in the male are at least as long as—in the female much shorter than—the preceding antennal joints together, and in respect of the hind tarsi, which are more or less shortened in the female. The comparatively slight difference in the spurs of the hind tibiæ has been referred to already.

Of the three species before me, either of two may possibly be Burmeister's species, as he mentions no character not found in them both, and gives no indication of locality beyond "Neu-Holland." One of the two referred to is from Victoria and Albury (New South Wales), the other from South Australia. The fact that European collections in early days received comparatively few species from the latter locality points to the probability of the *Antitrogus* from Victoria, etc., being *tasmanicus* Burm., and the conjecture is slightly strengthened by Burmeister's remark that the 3rd antennal joint is "nicht verlängerte"—a phrase that might fairly be applied to either of the two species I am discussing, but that indicates the Victorian one even more strongly than the other, in which the 3rd antennal joint, though short, is quite distinctly longer than the 4th joint. I presume the name "*tasmanicus*" to have been given in honour of the voyager Tasman. The species is assigned to Tasmania in Masters' Catalogue, but, as noted above, is not so assigned by the author. It may be noted here that an *Antitrogus* is found in Tasmania, but, even disregarding the author's statement of locality, is not likely to be his species, since it has black antennæ, and the antennæ of *tasmanicus* are especially mentioned as "red-brown."

The following tabulation indicates characters by which the *Antitrogi* known to me can be distinguished:—

A. Joint 3 of antennæ distinctly longer than joint 4 ... ... Burmeisteri, *Blackb.*
AA. Joint 3 of antennæ not longer than joint 4.
  B. Antennæ red ... . tasmanicus, *Burm.*
  BB. Antennæ black .. .. nigricornis, *Blackb.*

A. nigricornis, sp. nov., Mas. Subnitidus; nigropiceus, antennis nigris, pedibus et segmentis apicalibus 2 nonnihil rufescentibus; supra sat iridescens; prothoracis basi, coxis, sternisque dense fulvo-pilosis; elytris pilis

brevibus cinereis parum perspicuis sparsim vestitis; clypeo sat crebre subgrosse, fronte prothoraceque minus crebre magis subtiliter, punctulatis; antennis 10-articulatis, articulis 1o piriformi, 2o brevi subgloboso, 3o quam 2us parum longiori, 4o 3o sat æquali, 5o quam 4us paullo breviori intus dentiformi, 6o 7o que perbrevibus (intus spiniformibus), 8o-10o flabellum (hoc quam articuli ceteri conjuncti longiori) formantibus; prothorace quam longiori ut 5 ad 3 latiori, antice fortiter angustato, margine apicali emarginato, lateribus pone medium fortiter rotundatis (vel fere subangulatis), basi (partibus lateralibus exceptis) haud marginata; scutello transverso, fere ut prothorax punctulato; elytris sat crebre quam prothorax multo magis grosse punctulatis, costulis obtusis subobsoletis 3 instructis; pygidio crebrius subtilius (linea media sparsim excepta) punctulato; segmentis ventralibus fere ut pygidium punctulatis; pedibus longe ciliatis, sat crebre rugulose nec grosse punctulatis; tibiis anticis extus tridentatis; tarsis anticis quam tibiæ paullo longioribus, intermediis tibiis sat æqualibus, posticis quam tibiæ paullo brevioribus. Long, 11 l; lat., 5⅜ l.

This species is certainly somewhat close to that which I take to be *A. tasmanicus*, Burm., but differs strongly from Burmeister's description by its black antennæ and palpi and its piceous legs, and (from the specimens that I believe to be *tasmanicus*) also by its notably narrower and more parallel form. I have not seen the female. In one of the specimens before me the prothorax is a little rufescent on its sides.

Tasmania.

A. Burmeisteri, sp. nov., Mas. Subnitidus; fusco-brunneus, palpis pedibusque dilutioribus, antennis testaceis, abdomine antice piceo postice rufo; vix iridescens; prothoracis basi, coxis sternisque, dense fulvopilosis; elytris pilis brevibus pallidis sparsim vestitis; capite sat crebre subgrosse, prothorace minus crebre vix magis subtiliter, punctulatis; antennis 10-articulatis, articulis 1o piriformi, 2o brevi transversim globoso, 3o quam 2us sat longiori, 4o quam 3us sat breviori, 5o quam 4us parum breviori intus dentiformi, 6o 7o que brevibus intus spiniformibus, 8o-10o flabellum (hoc quam articuli ceteri conjuncti longiori) formantibus; prothorace quam longiori fere ut 5 ad 3 latiori, antice fortiter angustato, margine apicali emarginato, lateribus arcuatis, basi (parte mediana summa excepta) manifeste marginata; scutello transverso, fere ut prothorax punctulato; elytris sat

crebre quam prothorax multo magis grosse punctulatis, costulis obtusis subobsoletis 3 instructis; pygidio puncturis minutis confertis et aliis majoribus sat crebris impresso; segmentis ventralibus sat crebre punctulatis; pedibus longe ciliatis, sat crebre rugulose sat grosse punctulatis; tibiis anticis extus tridentatis; tarsis anticis quam tibiæ sat longioribus, posterioribus 4 tibiis sat æqualibus. Long., 11 l.; lat., 5½ l.

Easily distinguishable from *A. nigricornis* and from the species that I regard as *tasmanicus* by the 3rd joint of its antennæ very distinctly longer than the 4th joint (the 4th joint about equals two-thirds of the 3rd). The typical specimen of this species (I have a second example exactly like it, but badly damaged, and evidently from style of mounting, etc., a companion specimen) also differs from them by its dark ferruginous—not at all piceous and scarcely pruinose—body and its clear ferruginous legs and by its evidently longer tarsi. Both examples are males. The *Antitrogus* which I have mentioned above as taken in numbers by Mr. Griffith agrees with *Burmeisteri*, so far as I can discover, in all respects except colouring, but its colour is that of the species that I believe to be *tasmanicus*. The type of *Burmeisteri* and its companion specimen are from South Australia, but I have lost record of exact locality. I am almost sure, however, that the locality is not near Adelaide. On the whole there seems to me to be a doubt whether the examination of a series of fresh specimens of both sexes coloured like the type may not eventually reveal grounds for regarding the Henley Beach examples as specifically distinct.

South Australia.

ELATERIDÆ.

CREPIDOMENINI.

PARABLAX.

Dr. Schwartz (D.E.Z., 1906, p. 368) formed a new genus of the above name for certain species which had previously been attributed to *Metablax*, among them his *M. trisulcatus*. Two species (*bicolor*, Blackb., and *quinquesulcatus*, Blackb.) which I placed in the allied genus *Parasaphes* must also be transferred to this new genus *Parablax*.

ELATERIDÆ.

PHYSODACTYLINI.

The *Physodactylini* have been variously treated by authors. Lacordaire placed them in a family (*Cebrionides*) distinct from the *Elateridæ*. Dr. Schwartz, in the "Genera

Insectorum," places them in the latter family. I do not concur without hesitation in this arrangement, but as the classification of the "Genera Insectorum" will no doubt be widely followed, I accept it.

This group, like the *Cebrionidæ*, is easily distinguished from the true *Elateridæ* by tibiæ dilated and of triangular form (of the fossorial type) and furnished with strong development of spines. It has not hitherto been reported as occurring in Australia. It is represented in my collection by two specimens, for which it is necessary to form two new genera.

NULLARBORICA, gen. nov.

Frons declivis; labrum fortiter transversum; antennæ sat fortiter serratæ, articulis 3° quam 2^{us} multo longiori, 11° subappendiculato; prothorax a basi ad apicem angustatus, ad latera marginatus, margine (superne viso) sat continuo; prosternum antice truncatum, suturis sinuatis antice clausis postice nonnihil duplicatis; tarsi subtus haud laminati; coxæ intermediæ haud plane contiguæ; sulcus mesosternalis manifestus.

The characters cited above in combination distinguish this genus from those described in the "Genera Insectorum." It bears much superficial resemblance to *Antoligostethus*, but differs by its head obliquely declivous, the margins of its prothorax not bent down in the front part in such fashion as to be invisible from above, by the front of its prosternum more abruptly truncate and by its intermediate coxæ not in contact with each other but separated by a quite visible mesosternal cavity.

N. concinna, sp. nov. Rufo-brunnea; modice nitida; supra pilis brevibus suberectis sat dense vestita; antennis ultra prothoracis basin elongatis; capite crebre fortiter punctulato; prothorace quam trans basin latiori fere quarta parte breviori, supra sat æqualiter fere ut caput punctulato, antice modice angustato, margine antico bisinuato, lateribus fere rectis vix sinuatis, angulis posticis haud divaricatis intra marginem haud carinatis; scutello ovali; elytris quam prothorax plus quam triplo longioribus, sat fortiter striatis, interstitiis leviter convexis crebre minus subtiliter punctulatis, apice vix acuto fere rotundato; prosterno episternisque crebre subgrosse punctulatis; processu prosternali supra planato, postice abrupte declivi; coxis intermediis subcontiguis; sulco mesosternali manifesto; coxis posticis intus gradatim sat fortiter (sed supra trochanteres paullo magis fortiter) dilatatis; abdomine sat crebre sat fortiter punctulato;

tarsis posticis quam tibiæ vix brevioribus, articulis 1-4 gradatim brevioribus; unguiculis modice magnis. Long., $5\frac{1}{2}$ l.; lat., $2\frac{3}{5}$ l.

South-West Australia (Nullarbor Plains); given to me by Mr. French.

ANTOLIGOSTETHUS (gen. nov.).

Caput antice perpendiculare; labrum fortiter transversum; antennæ sat fortiter serratæ, articulis 3° quam 2^us^ multo longiori, 11° subappendiculato; prothorax a basi ad apicem angustatus, ad latera marginatus, margine antice fortiter deflexo (superne viso haud perspicuo); prosternum antice rotundatim truncatum, suturis sinuatis antice clausis haud duplicatis; tarsi subtus haud laminati; coxæ intermediæ contiguæ.

The characters cited above will serve in combination to distinguish this genus from all those described in the "Genus Insectorum." It is probably nearest to the South African genus *Oligostethus*, Schw., but differs from it by, *inter alia*, the antennæ strongly serrate from the 3rd joint inclusive, the strongly transverse labrum, and the prosternal sutures not open in front.

A. lucidus, sp. nov. Brunneo-testaceus; sat nitidus (præsertim pronotum); supra pilis brevibus erectis sat dense vestitus; antennis ultra prothoracis basin elongatis; capite crebre fortiter punctulato; prothorace quam trans basin latiori parum breviori, supra in disco sparsius subtilius (quam caput multo minus crebre multo minus fortiter) latera summa versus magis fortiter punctulato, antice sat fortiter angustato, margine antico rotundatim sat fortiter producto, lateribus fere rectis nonnihil sinuatis, angulis posticis haud divaricatis intra marginem haud carinatis; scutello ovali; elytris quam prothorax circiter triplo longioribus, sat fortiter striatis, striis latera versus fortiter punctulatis, interstitiis parum convexis sat crebre minus subtiliter punctulatis, apice vix acuminato fere rotundato; prosterno crebre fortiter, episternis sparsim subtilius, punctulatis; processu prosternali supra concavo, postice abrupte declivi; coxis intermediis contiguis; coxis posticis intus gradatim sat fortiter dilatatis; abdomine sat crebre sat fortiter punctulato; tarsis posticis quam tibiæ paulo brevioribus, articulis 1-4 gradatim brevioribus; unguiculis modice magnis. Long., $5\frac{1}{4}$ l.; lat., $1\frac{1}{2}$ l.

North-West Australia; Roebuck Bay.

Notes on South Australian Marine Mollusca with Descriptions of New Species.—Part XIV.

By Jos C. Verco, M.D. (Lond.), F.R.C.S. (Eng.).

[Read October 12, 1911.]

Plates XXVI. and XXVII.

Genus Dentalium.

Since 1904, when I wrote a paper on *Dentalium intercalatum*, Gould. (Trans. Roy. Soc., S.A., 1904, vol. xxviii., p 135), I have dredged in deeper waters, up to 300 fathoms, and have explored the coastline and dredged up to 35 fathoms as far west as St. Francis Island in Nuyts Archipelago, and Point Sinclair; also at Esperance Bay, King George Sound, Ellensbrook, Yallingup, off Bunbury in Geographe Bay, and at Rottnest Island, and off Fremantle in Western Australia.

As a great amount and a much varied kind of material has thus been accumulated I propose to review my previous Notes on *Dentalium* and other South Australian genera in the light of these collections.

Bossevain in "Scaphopoda of the Siboga Expedition, 1906," p. 22, under *Dentalium intercalatum*, Gld., reproduces my paper from the Trans. Roy Soc. of S.A.

In the paper on *D. intercalatum*, Gld., referred to I write:—"I have vainly endeavoured to discover more than one species among them. They are exceedingly variable, and were it not for intermediate forms quite a dozen species might be created." In going through the literature of *Dentalium* several species already created may from the description and figures be matched by my specimens, and so would seem to be but variations of the one abundant and protean species. Among these are the following:—

Dentalium duodecimcostatum, Brazier.

Dentalium duodecimcostatum, Brazier, Proc. Linn. Soc., N.S.W., vol. ii., 1877, p. 56. *Type locality*—Darnley Island, Torres Straits, 30 fathoms, sandy mud (Chevert Exped.); Pilsbry, Tryon, Man. Conch., 1897-8, vol. xvii., p. 13; Hedley, Records Austr. Mus., 1901, vol. iv., p. 128, pl. xvii., fig. 31; Bossevain, Scaphopoda of Siboga Exped., 1906, p. 15.

Dredged in 22 fathoms in Gulf St. Vincent, 22 in good condition, some alive.

The only difference between the unique type specimen and mine is that the latter attain the length of only 9 lines instead of 11.

Dentalium cheverti, Sharp and Pilsbry.

Dentalium cheverti, nom. mut., Sharp and Pilsbry, Tryon, Man. Conch., 1897-8, vol. xvii., p. 9; Hedley, Records Austr. Mus., 1901, vol. iv., No. 3, p. 129, pl. xvii., fig. 34; Bossevain, Scaphopoda, Siboga Exped., 1906, p. 17.

Dentalium septemcostatum, Brazier, Proc. Linn. Soc., N.S.W., 1877, vol. ii., p. 57 (*nom D. septemcostatum*, Abich, 1859). *Type locality*—Evan Bay, Cape York, North Australia, 6 fathoms, sand (Chevert Exped.).

Dredged in 22 fathoms in Gulf St. Vincent, 2 in good condition, 13 mm. long.

Dentalium katowense, Brazier

Dentalium katowense, Brazier, Proc. Linn. Soc., N.S.W., 1877, vol. ii., p. 56. *Type locality*—Katow, New Guinea, 8 fathoms, sandy mud and coral; Pilsbry and Sharp, Tryon, Man. Conch, 1897-8, vol. xvii., p. 9; Hedley, Records Austr. Mus., 1901, vol. iv., No. 3, p. 129, pl. xvii., fig. 33; Bossevain, Scaphopoda, Siboga Exped., 1906, p. 16.

Dredged in 15 to 22 fathoms in Gulf St. Vincent, 4 in good condition. The longest is 22·5 mm. Mr. Hedley writes: "This answers fairly to my specimens from the Gulf of Carpentaria."

Brazier in the definition of his species writes, "interstices with minute lengthened striæ." If the specimens of *D. intercalatum*, Gld., from South Australia are carefully examined under a lens when their larger end is toward the light they will show their transverse accremental striæ very plainly, but when they lie with their side toward the light these are quite indistinct, and fine axial striæ are visible. The relative validity of these axial and concentric striæ varies in different examples. They are to be seen in my specimens labelled *D. katowense*.

Dentalium thetidis, Hedley.

Dentalium thetidis Hedley, Memoirs Austr. Mus., 1903, vol. iv., p. 327, fig. 61. *Type locality*—"In 63-75 fathoms off Port Kembla; also in 41-50 fathoms off Cape Three Points."

Dredged in 6 fathoms off Black Point, Gulf St. Vincent, 1 fresh; in 15 to 22 fathoms Gulf St. Vincent, 2 good; in 130 fathoms off Cape Jaffa, 2 fresh, 7 dead; in 300 fathoms off Cape Jaffa, 3 dead. Identified by cotypes from Mr. Hedley. In the two fresh specimens from 130 fathoms, close to the posterior end, in the furrow on each side next to the central furrow on the convex surface, are four minute holes in an axial line. These are probably only accidental. They may be the boreholes of predacious molluscs. Still it is a curious coincidence to find them in two specimens, in identically the same position; and the coincidence is more striking

since they occur only in these two instances, among several hundred *Dentalium* shells. These are often bored, but generally only in one or two holes and in other parts of the shell. However, it would be perilous to construct another species to include these two examples, which in all other respects resemble the rest under this name. My longest individual measures 20 mm. by 2·25 mm. Hedley's type is 8 mm. by 1 mm., and probably immature.

Dentalium bednalli, Pilsbry and Sharp.

Dentalium bednalli, Pilsbry and Sharp, Tryon, Man. Conch., 1897-8, vol. xvii., p. 248, pl. xxxix., figs. 1, 2, and 3. *Type locality*—Gulf St. Vincent, South Australia. (?) *D. octogonum*, Lam., Angas, Proc. Zool. Soc., 1878, p. 868; Adcock, Handlist Aquatic Moll., S.A., 1893, p. 10.

Dredged in 15-22 fathoms in Gulf St. Vincent, 59 specimens with 7 ribs posteriorly and a varying number anteriorly; after the previous 7-angled varieties have been picked out.

Dentalium octopleuron, n. var.

This shell is like *D. bednalli*, Sharp and Pilsbry, except that it has 8 ribs at the posterior end instead of 7. In 4 specimens the 8 costæ run throughout the shell, which may measure 20 mm. in length. But in all the others riblets arise; it may be in only one or in two, or up to all the intercostal spaces. These riblets may number as many as 4 in a space; they may equal in size the primary ribs, if they are few, or they may remain small, especially if numerous.

Dredged in 15 to 22 fathoms in Gulf St. Vincent, 88 in good condition. This variety is the most common in our shallower waters, and this would be the form found by Angas on Henley Beach and named by him *D. octagonum*, Proc. Zool. Soc., 1878, p. 868.

Type in Dr. Verco's collection.

Dentalium robustum, Brazier.

Dentalium robustum, Brazier, Proc. Linn. Soc., N.S.W., 1877, vol. ii., p. 56. *Type locality*—Katow, New Guinea, 8 fathoms, sandy mud and coral (Chevert Exped.); Pilsbry and Sharp, Tryon, Man. Conch., 1897-8, vol. xvii., p. 12; Hedley, Records Aust. Mus., 1901, vol. iv., No. 3, p. 128, pl. xvii., fig. 32; Bossevain, Scaphopoda, Siboga Exped., 1906, p. 29.

Dredged in 15 to 22 fathoms in Gulf St. Vincent, 16 in good condition. These, like the type, have 9 ribs throughout. Besides these 28 other specimens from the same locality have 9 ribs posteriorly and more than 9 anteriorly.

Dentalium decemcostatum, Brazier.

Dentalium decemcostatum, Brazier, Proc. Linn Soc., N.S.W., 1877, vol. ii., p. 55. *Type locality*—Katow, New Guinea, 8 fathoms, sandy mud (Chevert Exped.); Pilsbry and Sharp, Tryon, Man. Conch., 1897-8, vol. xvii., p. 8; Bossevain, Scaphopoda, Siboga Exped., 1906, p 27.

Dredged in 15 to 22 fathoms in Gulf St. Vincent, 10 good; with 10 ribs throughout, with 10 ribs posteriorly, and more than 10 anteriorly, 24 good.

Dentalium francisense, n. sp. Pl. xxvi., figs. 1 and 1*a*.

Shell moderately solid, narrow, curved, less anteriorly, translucent white, with 14 broad, low, round ribs extending throughout, separated by distinct linear interspaces. Fine transverse microscopic growth lines. Anterior aperture circular, margins thin, scarcely scalloped. Posterior end truncate, aperture small, border thick, shape oval, elongate antero-posteriorly.

Dimensions.—Length, 28 mm.: diameter—anteriorly, 3·2 mm.; posteriorly, 1·6 mm. A much younger individual measures 13·5 mm. in length, 2·4 mm. in its anterior diameter, and 8 mm. in its posterior. It is much more curved and has a slightly projecting appendical tube.

Locality.—In 15 to 20 fathoms in Petrel Bay, St. Francis Island, type with 4 others (2 alive): in 35 fathoms off St. Francis Island, 1 good; in 15 to 22 fathoms in Gulf St. Vincent, 9 good; in 55 fathoms north-west of Cape Borda, 1 good: in 15 fathoms in Geographe Bay, Western Australia, 1 good.

This shell varies. There may be only 11 ribs throughout, of which I have two examples from Gulf St. Vincent, or 11 ribs posteriorly, and more anteriorly up to 22 from intercalated riblets, 13 examples from the same locality.

There may be 12 ribs posteriorly and 12 anteriorly, and these may be typically broad and round, or rather narrow and flat, 4 examples; or of intermediate width, 9 examples; or 12 ribs posteriorly and 2 or more additional riblets anteriorly, 4 examples, all dredged in 15 to 22 fathoms in Gulf St. Vincent.

There may be 13 ribs throughout, as in 11 examples from 15 to 22 fathoms in Gulf St. Vincent.

There may be 15 ribs throughout, as in 9 examples from 15 to 22 fathoms in Gulf St. Vincent.

There may be 18 ribs throughout, as in 1 example from Port Lincoln, but this is a large old individual, with a relatively great posterior diameter, and probably had fewer ribs earlier in life.

Type in Dr. Verco's collection.

I am inclined to think that even this species is but an extreme variant of the *D. intercalatum*, Gld. It would seem as though the more initial ribs are present at the posterior end, the fewer interstitial ribs arise, which is easily understood; and the more likely they are to be round and broad and encroach on the intercostal spaces. Still one may meet with an occasional specimen starting with 11 ribs which increase up to 24, and are rather narrow; or with one which starts with only a few ribs, 7 or 9, and these become broad and rounded.

The following species of *Dentalium* appear to be distinct from *Dentalium intercalatum*, Gld., with its many varieties:—

Dentalium hemileuron, n. sp. Pl. xxvi., fig. 2.

Shell long and narrow, very slightly curved, mostly at the hinder part, white opaque when dead, translucent when fresh, and glistening, rather thick. There are 10 axial ribs, valid, narrow, about one-fourth the width of their interspaces, less valid and less distant on the convex side. Well developed in the posterior half, then becoming quickly obsolete and absent from the anterior third. There is no increase in number as the shell grows larger, close transverse scratch marks, and circles of varying opacity make the ornament. Anterior aperture round. Posterior aperture round, but on the convex surface it has a sinus about as deep as wide with convex margins.

Dimensions.—Length, 30 mm.; greatest width, 2·4 mm.; smallest, 4 mm.

Locality.—Dredged in 300 fathoms off Cape Jaffa, type with 20 in good condition (some alive), 51 in poor; in 130 fathoms off Cape Jaffa, 37 (some alive); in 150 fathoms off Beachport, 1 poor; in 200 fathoms, 1 moderate.

In a young individual the ribs are traceable to within 2 mm. of the end, where the diameter was only ·3 mm., beyond which ribs were absent and only transverse scratchings were visible; the extreme 2 mm. cap, as it were, the part beyond. The largest example measures 34 mm. Some have 9 ribs, some 8, some 11.

Diagnosis.—There are no axial interstitial riblets as in *D. thetidis*, Hedley, nor increase in the number of ribs by splitting or intercalation, as in *D. intercalatum*, Gld., and the anterior part is ribless.

Type in Dr. Verco's collection.

Dentalium zelandicum, Sowerby.

Dentalium zelandicum, Sowerby, Thes. Conch., 1860, vol. iii., p. 101, sp. 31, pl. ccxxiii., fig. 13. *Type locality*—New Zealand; Reeve, Conch. Icon., 1872, vol. xviii., pl. ii., fig. 8; Lesson, Conch. Cab. (Ed. Küster), 1896, Band. vi., Abt. 5, p. 15, sp. 23, pl. iv., fig. 4; Pilsbry and Sharp, Tryon, Man. Conch., 1897-8, vol. xvii., p. 70, pl. vi., fig. 81; Murdoch and Suter, Trans. New Zealand Institute, 1905, vol. xxxviii., p. 304, 110 fathoms off Great Barrier Island. It is from one of these specimens kindly given me by Mr. Suter that mine are identified.

Dredged in 130 fathoms off Cape Jaffa, 5 good and 12 fragments; in 110 fathoms off Beachport, 1 dead; and in 200 fathoms, 1 fragment large but eroded.

The radula, pl. xxvii., fig. 7, has the formula 1.1.1.1.1., with a wide low central cusp, a lateral provided with several small denticles at its inner lower part, and an oblong rhomboidal marginal.

My largest specimen attains a length of 55 mm., with a width of 6 mm., and has 32 axial ribs, the smaller of which arise by intercalation. A specimen of 20 mm. in length, with about 2 mm. of the apical end unsculptured, has a distinct fissure of 4 75 mm. long on the convex surface; another of the same size and age shows none; a third younger still has 4 mm. unsculptured and no fissure. The fissure in this section of *Dentalium* appears to be only occasionally and not always present; just as does the appendical tube in another section.

Dentalium virgula, Hedley.

Dentalium virgula, Hedley, Memoirs Austr. Mus., vol. iv., 1903, p. 328, fig. 62. *Type locality*—"Numerous examples were taken in 63-75 fathoms off Port Kembla, in 41-50 fathoms off Cape Three Points, in 54-59 fathoms off Wata Mooli, and in 50-52 fathoms off Botany Bay."

Dredged in 60 and 62 fathoms off Cape Borda, 43 moderately good; in 90 fathoms off Cape Jaffa, 23 alive and many dead and pieces; in 104 fathoms south-west of the Neptune Islands, 7 good, 44 moderate: in 110 fathoms off Beachport, 4 alive, 21 dead; in 130 fathoms off Cape Jaffa, 3 moderate; in 150 fathoms off Beachport, 93 moderate; in 200 fathoms off Beachport, 4 poor.

Some examples have slight annular constrictions at intervals of 3 mm. Here the shell is less opaque-white, and the opacity gradually increases anteriorly, as though at the constriction the shell were thinner, representing a more rapid growth after a period of lessened activity or of rest. The appendix is visible in very early life, when the shell is extremely narrow. There seems to be a great tendency to transverse fracture when the shell is nearly filled up by in-

ternal deposit, so that numerous fragments are found from 3 mm. upwards in length, and with the appendix projecting, resemble candle-ends. When the appendix is absent in the early stages of growth the shell is not unlike juvenile *D. lubricatum*, Sowerby, but does not increase quite so rapidly, and has more marked transverse striation.

Dentalium lubricatum, Sowerby. Pl. xxvi. figs. 4 and 4*a*.

Dentalium lubricatum, Sowerby, Thes. Conch., vol. iii., 1860, p. 97, sp. 3, pl. ccv., fig. 56. *Type locality* Australia; Reeve, Conch. Icon., vol. xviii., 1872, pl. vii., fig. 55; Brazier, Proc. Linn. Soc., N.S.W., vol. ii., 1878, p. 370; Lesson, Conch. Cab. (Ed. Küster), Band. vi., Abt. 5, 1896, p. 14, sp. 22, pl. iv., fig. 3; Pilsbry, Tryon, Man. Conch., vol. xvii., 1897, p. 110, pl. xix., fig. 22; Hedley, Memoirs Austr. Museum, vol. iv., 1903, p. 328; Pritchard and Gatliff, Proc. Roy. Soc., Vic., vol. xv. (N.S.), 1903, part 2, p. 222.

Sowerby's definition in full is "shell polished, elongate, white, subpellucid, slightly curved, scarcely fissured, gradually increasing." Brazier adds "off Port Jackson Heads, 45 fathoms, hard sand bottom. This fine shell was obtained when H.M.S. 'Challenger' dredged one day off Sydney Heads." Lesson says the apex is whole and is not incised, but gives no authority, whereas Sowerby defines it as "scarcely fissured." Pilsbry supplies the dimensions of Sowerby's figure, "length, 64 mm.; greatest width, 6 mm.," but it is not known whether the figure was only life size.

Hedley records the species:—"Several specimens were obtained from 63-75 fathoms off Port Kembla, of which the largest is 32 mm. long; and from 41-50 fathoms off Cape Three Points; Pritchard and Gatliff extend the locality to Cowes, Port Phillip Island, Western Port."

Dredged in 40 fathoms off Beachport, 6 good; in 55 fathoms off Cape Borda, 7 good and 7 poor; in 60 and 62 fathoms off Cape Borda, 30 good of varying size and 93 immature; in 90 fathoms off Cape Jaffa, 6 good and 3 poor; in 104 fathoms 35 miles south-west of the Neptune Islands, 2 good and 18 poor and immature; in 110 fathoms off Beachport, 3 good and mature; and in 150 fathoms, 1 moderate. No living examples were taken.

With reference to the slit my material shows that in the very early stage of growth there is no slit, but a central posterior aperture; the length of the slit may vary from a mere notch to a fissure of 2·5 mm. in length in a shell of 36·5 mm., or of 8 mm. length in an individual of 26·5 mm. It is always on the convex or ventral aspect. It is sometimes a mere crack, the two sides of which seem in apposition. At others it is an open slit of nearly ½ mm. in width; or the posterior

third may be a slit and the anterior two-thirds a crack; and this crack may seem to be wider inside the shell, as though it were absorbed from within; and sometimes the crack connects two or three holes where the erosion has come through. In two examples there project from the posterior end on each side a short lamina about ½ mm. long, a continuation of the internal layer of the shell. The largest individual dredged is 36·5 mm. long and 3·25 mm. at its widest part. In some examples the dorsal part near the posterior end is spotted or blotched with opaque-white.

I was fortunate enough to dredge two specimens which show the extreme posterior end, figured in pl. xxvi., fig. 4*a*. It is an elliptical bulb, and has a very short, slightly-contracting, round tubular posterior prolongation set somewhat obliquely to the axis of the bulb, and directed toward the convex side of the shell. Transverse rings of varying opacity are visible in the first 1½ mm. of the shell. The figure represents the earliest 2 mm. of the shell.

Cadulus acuminatus, Tate.

Cadulus acuminatus, Tate, Trans. Roy. Soc., S.A., 1887, vol. ix., p. 194. In 1904 vol. xxviii., p. 138, I discussed it fully.

Dredged since then in 26 fathoms 30 miles south-east of Newland Head, 2 alive; and in 28 fathoms close by, 6 alive; in 62 fathoms north-west of Cape Borda, 2; and in 90 fathoms off Cape Jaffa, 67 in good condition.

Cadulus angustior, n. sp. Pl. xxvi., figs. 5, 5*a*, 5*b*.

Shell thin, slightly curved, chiefly in the posterior half, cylindrical, very gradually increasing from behind, and very slightly narrowed at the front, scarcely compressed laterally.

Fractured at the posterior end at right angles to the curve, and with a small triangular spine, ·1 mm. long, projecting backwards from the convex side. Anterior end open, sloping obliquely forwards from the convex side. Margins simple and smooth. Shell smooth, diaphanous.

Dimensions.—Length, 4·6 mm.; breadth, ·6 mm.

There is a transverse milky line near the front; other specimens want this, and some may have one near the posterior end.

Locality.—Twenty-six fathoms 18 miles south-east of Newland Head, outside Backstairs Passage, type with several scores alive; 62 fathoms north-west Cape Borda, 8 good.

Diagnosis.—It differs from *C. acuminatus*, Tate, in being narrower and more cylindrical, with less bulging about the middle.

With these were found many specimens of two other forms—one like a very minute *Dentalium* of about the same length, much narrower at its posterior end, which is provided with a similiar spine projecting from the convex side. The anterior end is fractured. The other form gradually increases to a diameter just about equal to that of the posterior end of the *Cadulus*, then contracts, and then expands again, and gradually attains the diameter of the middle of the *Cadulus*; here it is fractured. These appear to be three progressive stages of its growth—first, as a *Dentalium*-like shell, which becomes constricted when it reaches a certain age, then begins to form the proper *Cadulus* shell, from which it subsequently breaks off, leaving the tiny projecting spine beyond the line of fracture.

Type in Dr. Verco's collection.

Cadulus spretus, Tate and May.

Cadulus spretus, Tate and May, Trans. Roy. Soc., S.A., 1900, vol. xxiv., p. 102. *Type locality*—Port Esperance, Tasmania, in 24 fathoms (W. L. May); Tate and May, Proc. Linn. Soc., N,S.W., 1901, vol. xxvi., p. 420, pl. xxv., fig. 52; Hedley, Memoirs Austr. Mus., 1903, vol. iv., p. 328, in 41-75 fathoms off coast of New South Wales; also 5 fathoms in Dusky Sound, New Zealand; Hedley and May, Records Austr. Mus., 1908, vol. vii., No. 2, p. 113, in 100 fathoms off Cape Pillar, Tasmania.

Dredged in 55 fathoms north-west of Cape Borda, 5 good; in 62 fathoms north-west of Cape Borda, 36 good; in 90 fathoms off Cape Jaffa, 6 good; in 110 fathoms off Beachport, 6 good; in 130 fathoms off Cape Jaffa, 18 good; in 150 fathoms off Beachport, 20 moderate; in 300 fathoms off Cape Jaffa, 1 poor. These are identical with cotypes sent to me by Mr. May.

At the following localities and depths a modified form was dredged:—Sixty-two fathoms north-west of Cape Borda, 3 good; in 90 fathoms off Cape Jaffa, 22 good; in 110 fathoms off Beachport, 3 good; in 130 fathoms off Cape Jaffa, 2 good; in 150 fathoms off Beachport, 5 good and 3 moderate. These have at one point in their length a sharp annular constriction, beyond which the shell often has a slightly altered axis, and at times a somewhat different curve. The relative length of the two portions varies; the earlier or the later part may form nearly the whole, or there may be any intermediate proportion. No complete *Cadulus* similar to *C. acuminatus*, Tate, was taken in these dredgings. Mr. May says that in the type locality, where several dozen cotypes were taken, no *C. acuminatus*, Tate, were obtained. Yet the constriction at the anterior end of *C. spretus* suggests that it is only the

initial half of a *Cadulus*, similar to *C. acuminatus*, and the presence of both portions of *C. angustior*, Verco, in its own locality heightens the probability; and these more or less fully formed individuals of *C. spretus* prove it.

Cadulus (Polyschides) gibbosus, n. sp. Pl. xxvi., fig. 6.

Shell smooth, polished, narrow, somewhat fusiform, slightly compressed dorso-ventrally, smaller behind; greatest diameter at the junction of the middle and anterior third; dorsal surface obtusely angled at this point; ventral surface almost uniformly convex. Anterior end sloping forward from the convex to the concave surface, mouth rather wider than high. Posterior end with a slit on each side, one on the convex surface and a wider curve on the concave. Colour milky-white, least opaque in the middle third, most in the anterior and along the concave side of the shell. It is somewhat obliquely striatedly painted. At 1 mm. from the posterior end is a transverse colourless line.

Dimensions.—Length, 9·7 mm.; greatest diameter, 1·8 mm.; diameter of the posterior end, ·45 mm.; of the anterior end, 1·1 mm.

Locality.—In 300 fathoms off Cape Jaffa, type with 3 others full grown, and 18 immature or fragments; in 130 fathoms off Cape Jaffa, 4 moderately good and 2 immature.

Type in Dr. Verco's collection.

Turbo jourdani, Kiener. Pl. xxvii., figs. 1 to 6*a*.

In the Transactions of this Society, vol. xxxii., 1908, pp. 338 to 340, I gave some notes on this species, with a description of its operculum. I was unaware at the time that Dr. Cox had described the operculum in Proc. Linn. Soc., N.S.W., ser. ii., vol. iv., 1889, p. 189, from a specimen taken in Geographe Bay, Western Australia.

His shell was 14 cm. long by 12·5 cm. wide, and its operculum was 95 mm. by 80 mm. Since my Note I have received a beautiful example from Mr. Elliot, of *The Register* office, which was found with the fish in it on Wedge Island at the entrance to Spencer Gulf. This measures 21 cm. in length by 18·5 cm., in the greatest diameter of its body-whorl, so that it is just half as large again as Dr. Cox's specimen. But at Esperance Bay, in Western Australia, one was given to me measuring 22·3 cm. in length by 21 cm. in the greatest and 14 cm. in the smallest diameter of its bordy-whorl. It is a splendid great shell. Dr. Cox's specimen extends its *habitat* to Geographe Bay; but I took it at Rottnest Island, opposite Fremantle, and the lighthouse-keeper there (Mr.

Waters) has taken it alive. This carries it a little farther north. In September of this year Mr. Arnold, of St. Francis Island, sent me a specimen in spirit which was taken alive in Petrel Bay. This measures 11 cm. by 9½ cm., and has an operculum measuring 44 mm. by 39 mm., and 11 mm. in its thickest part This thickest part is adjacent to the columella, and is white, while the part immediately over the depressed centre of the spiral and the narrower outer edge is of a cloudy-brown colour.

From the animal I was able to get the radula, which measured 40 mm. by 5 mm., and contained 76 rows of teeth. The formula is 39.5.1.5.39, or, as it might more exactly be written, (32.6.1) (1.4) .1. (4.1) (1.6.32). There is a central tooth (pl. xxvii., fig. 6), which has a flange on each side to overlap the adjacent edge of its neighbours. Each of these laterals overlaps the next tooth outside. The outermost lateral (fig. 4) has its upper border bent over and provided with a strong cusp at its inner end. This gives it a different appearance from all its fellows, and when the whole series is seen this tooth stands out very prominently, as in pl. xxvii., fig. 4. There are three kinds of teeth in the marginals. The first six (fig. 2) have stout bases surmounted by a bold polished cusp, and they gradually diminish in size outwardly, as seen in fig. 2 *in situ* and in fig. 2*a*, when dissected out; the three inner ones overlap the outer at their bases, and otherwise lie in part behind them. The three outer have not this overlapping lamina. Then follow 32 (approximately, varying in different rows) slightly-curved, narrow flat acicular teeth with obsoletely denticulated tops (fig. 1). But there is one tooth placed *immediately behind* the first and largest lateral, solitary, out of line with the rest, and when examined *in situ* appearing somewhat sickle shaped, as in pl. xxvii., fig. 3; but when separated resembling the others, as in fig. 3*a*. I have not seen any notice of this particular marginal tooth in the literature of the radula at my disposal; but I find it also in that of Turbo Gruneri.

Pseudamycla dermestoidea, Lamarck.

Buccinum dermestoideum, Lamarck, 1822, Hist. Nat. Anim. S. Vert., vol. vii., p. 275.

Pyrene lineolata, Tryon, Verco, Trans. Roy. Soc., S.A., vol. xxxiv., 1910, p. 131.

Pseudamycla dermestoidea (Lam.), Pace, Proc. Mal. Soc, Lond., 1902, vol. v., pp. 255, 267. Here Pace creates a new genus, *Pseudamycla*, for this species, which he separates from *Columbella*, and of which he gives a large bibliography. At the time of its publication I separated my cabinet specimens from *Columbella* and put them in the new genus *Pseudamycla* among the

Pisaniinæ, and so overlooked them when working up my *Columbellas* last year and wondered how I had so little material. Consequently I can add the following locality:—Port Elliot and Middleton beach, fairly common.

Pseudamycla miltostoma, Tenison-Woods.

Columbella miltostoma, n sp., J. E. Tenison-Woods, Proc. Roy. Soc., Tas, 1877 (1876), pp. 134-5.

Pseudamycla miltostoma (Ten.-Wds., as *Columbella)*, Pace, Proc. Mal Soc., Lond., 1902, vol. v., pp. 268-9.

Pyrene miltostoma, Tenison-Woods, Verco, Trans. Roy. Soc., S.A., vol. xxxiv., 1910.

Dredged in Gulf St. Vincent, depth unrecorded, 18 moderate.

NOTES ON THE MARINE SHELLS OF WESTERN AUSTRALIA, WITH DESCRIPTIONS OF NEW SPECIES.
PART I.

By Jos. C. Verco, M.D. (Lond.), F.R.C.S. (Eng.).

[Read October 12, 1911.]

Plate XXVI.

In December, 1910, and January, 1911, I visited Western Australia and collected shells from the shores at Esperance Bay, Hopetoun, and King George Sound on the south coast; and from Ellensbrook and Yallingup, south of Cape Naturaliste; from Bunbury, and the shores of Rottnest Island. I also dredged a little in Esperance Bay; had two casts with the bucket-dredge in 35 fathoms, a little west of Hopetoun, through the kindness of Captain Walden, of the S.S. "Ferret"; a good deal of dredging in 12 to 14 fathoms and 22 to 28 fathoms, and 35 fathoms in King George Sound; a good deal in Geographe Bay in 15 and in 22 fathoms; and several casts off Fremantle, in 6 fathoms and in 15 fathoms from the Government tug-boat "Penguin," through the kindness of Captain Winzor (the harbour master) and of Captain Airey (master of the "Penguin").

I propose, therefore, as I take up the different genera and deal with my more extensive South Australian material to identify and record also all known Western Australian forms gathered by me, and describe any new species found.

I may say that of more than 400 different species collected in the West the very large majority of them are identical with or closely resemble our "Adelaidean fauna," as Mr. Hedley has called it.

Dentalium intercalatum, Gould.

Dredged in 10 to 12 fathoms off Fremantle, 2 fragments, with valid narrow ribs and intercalated riblets, recalling the above species.

Dentalium francisense, Verco, *antea*.

Dredged in 35 fathoms off Hopetoun, 1 moderately good with an appendix; in Geographe Bay in 15 fathoms, 4 moderate; in 22 fathoms, 2 good and 6 moderate; off Fremantle in 6 fathoms, 1 good; and in 10 to 12 fathoms, 1 poor. Taken on Bunbury Beach, 4 rolled; and on Rottnest Island, 2 rolled.

Dentalium hyperhemileuron, n. sp. Pl. xxvi., figs. 3 and 3*a*.

Shell long and narrow, very slightly curved, mostly at the hinder part, white when dead, translucent when fresh, and glistening, rather thin. There are 12 axial ribs, invalid, and narrow; no increase in number with age; becoming obsolete early, so as to leave the anterior two-thirds of shell smooth but for very fine accremental scratch lines. Interstices nearly flat, slightly concave. Anterior orifice round, margin thin and simple. Posterior end truncated, with a long narrow diaphanous appendix directed eccentrically dorsally. The growth lines on the appendix form a convexly bordered sinus on the ventral surface about as wide as deep, and a scarcely depressed margin on the dorsal surface.

Dimensions.—Length, 20 5 mm.; greatest width, 1·8 mm.; least width, 7 mm.; length of appendix, 2 2 mm.; diameter, ·4 mm.

Locality.—King George Sound, Western Australia, in 12-14 fathoms, 200, several alive; in 22-28 fathoms, 60, several alive; in 35 fathoms, 4 dead but good; Geographe Bay in 15 fathoms, 6 dead but good; in 22 fathoms, 4 dead; off Fremantle in 10-12 fathoms, 20 poor.

Some individuals with perfect posterior ends run down to a diameter of ·3 mm., and are there diaphanous and ribless, and have only growth striæ. Others more mature and with a posterior end of 1 mm. in diameter, and without an appendix, are here bevelled internally and thinner on the convex side, where there is a shallow triangular notch. The largest example is 30 75 mm. long by 2·3 mm. wide. The ribs may vary in number from 10 to 16 in different individuals.

Diagnosis.—It very closely resembles *D. hemileuron*, Verco, in the ribless anterior portion and the never-increasing ribs of the posterior end, and in their extension to within 2 mm. of the end in very young individuals and in the ventral notch at the hinder extremity; but the latter has no appendix, and the ribs are more valid and do not so soon become obsolete, and it is not found in such shallow water. But I think probably the absence of the appendix may be only an accidental circumstance, and the shallower water in which the Western Australian species lives may account for the other differences, and that this is only a local variety.

One individual, dredged in Geographe Bay at a depth of 15 fathoms, measures 4 mm. in length by ·5 mm. in diameter at the anterior end. It has the apical end complete. The first portion of this, measuring 1·9 mm., has been

figured, and shows an initial elliptical section ·35 mm. in length by ·22 mm. in greatest width, and having a round hole in its end of about ·15 mm. in diameter with a simple border; a second curved cylindrical section of ·36 mm. long by ·20 wide; a third slightly conical section of ·60 mm. long by ·35 mm. wide in its greatest diameter; and a fourth section of ·65 mm. long by ·40 mm. wide. The second section has its walls slightly corrugated, so as to give them a faintly undulating outline, with broad shaded transverse bands, which are visible also in the anterior half of the first section. The third segment is smooth but for very fine accremental transverse scratches. The fourth shows the commencement of the axial ribs, which gradually enlarge with the growth of the shell.

As this example so beautifully reveals the beginning of a *Dentalium* I have had it figured.

Type in Dr. Verco's collection.

Dentalium lubricatum, Sowerby.

Dredged off Hopetoun in 35 fathoms, 5 good, dead.

Cadulus occiduus, n sp. Pl. xxvi., fig. 7.

Shell rather solid; ventral curve nearly uniformly slightly convex, more at the posterior part; dorsal side nearly straight in the anterior fourth, slightly convex in the next quarter, and slightly concave in the hinder half. It is cut off perpendicularly to the axis behind, rather obliquely in front, where the slope is backward toward the convex side. There is a slight dorso-ventral compression of the tube, so that both the apertures are slightly flattened, especially on the convex side. Surface smooth but for scanty transverse microscopic scratches. Colour white, more opaque anteriorly, and in transverse lines.

Dimensions.—Length, 9·6 mm.; anterior diameter, 1 mm.; posterior, ·5 mm.; greatest diameter, 1·4 mm..

Locality.—Geographe Bay, off Bunbury, in 15 fathoms, type with 7 others; off Fremantle in 10 to 12 fathoms, very many.

Among the many specimens taken considerable variety obtains. Some full grown may measure only 5 mm. in length and be proportionally narrow, and the inflation on the concave side may be less in all degrees, almost to disappearance.

Cadulus angustior, Verco, *antea*.

Dredged in 35 fathoms off Hopetoun, 3 good; in King George Sound in 12-14 fathoms, 40 good; in Geographe Bay in 15 fathoms, 30 good.

EXPLANATION OF PLATES.

PLATE XXVI.

1\. *Dentalium franciscense*, Verco, n. sp.
1*a*. ,, ,, ,, ,, young.
2\. ,, *hemileuron*, Verco, n. sp.
3\. ,, *hyperhemileuron*, Verco, n. sp.
3*a* ,, ,, ,, early stage.
4\. ,, *lubricatum*, Sowerby, early stage.
4*a*. ,, ,, ,, apex.
Cadulus angustior, Verco, n. sp.
5*a* ,, ,, initial stage.
5*b*. ,, ,, medium stage.
6\. *gibbosus*, Verco, n. sp.
occiduus, Verco, n. sp.

PLATE XXVII.

1 to 6. *Turbo jourdani*, Kiener, half of one row from the radula.
1, 2, 3. ,, ,, ,, marginal teeth.
4, 5. ,, ,, ,, lateral teeth.
6\. ,, ,, ,, central tooth.
1*a*. ,, ,, ,, outermost marginals.
2*a*. ,, ,, ,, inner marginals.
3*a*. ,, ,, ,, innermost maginal.
4*a*. ,, ,, ,, outermost lateral.
5*a*. ,, ,, ,, other laterals.
6*a* ,, ,, ,, central.
7\. *Dentalium zelandicum*, Sowerby, one row from the radula.

ABSTRACT OF PROCEEDINGS

OF THE

Royal Society of South Australia

(Incorporated)

FOR 1910-11.

ORDINARY MEETING, NOVEMBER 1, 1910.

Mr. MAYO in the chair.

ELECTION.—Professor Bragg was elected an Honorary Fellow of the Society.

Mr. ASHBY drew attention to the recent destruction of kangaroos on Kangaroo Island and moved that a deputation of members of the Society wait on the Commissioner of Crown Lands in connection with the matter. Resolved "That the President, Secretary, Mr. Ashby, and Mr. Howchin form the deputation, with power to add to their number."

EXHIBITS.—Mr. ASHBY exhibited birds from the Dandenong Ranges, Victoria; Mr. TEPPER, insects; and Dr. PULLEINE, trapdoor spiders from Burnett River, Queensland.

PAPERS.—"On Tetrahedrite from Glen Osmond Quarry," "Further Notes on Radio-Active Minerals from Olary," "On Obsidianites," and "Mineralogical Notes on Sphene, Pegmatite, Cordierite, Sillimanite, Beryl, and Semi-artificial Gypsum Twin Crystals from a Steam-boiler at Block 14 Mine, Broken Hill, New South Wales," by DOUGLAS MAWSON, D.Sc.

ORDINARY MEETING, APRIL 4, 1911.

THE PRESIDENT (J. C. Verco, M.D., F.R.C.S.) in the chair.

EXHIBITS.—Mr. E. V. CLARK, B.Sc., exhibited silicified wood from Scone, New South Wales, where it is abundantly scattered about the country. In the opinion of several Fellows the wood belonged to a species of pine allied to Araucaria, as the structure of the wood and annual rings were easily recognizable. Mr. CLARK also exhibited native sulphur from Mount Wingen, near Scone, where a gradually moving area of subterranean combustion is seen on the hillside, probably caused by combustion of the deposits of pyrites. Mr. HOWCHIN described the spontaneous combustion of pyrites which took place in the waste coal heaps in England. Dr. E. A. JOHNSON exhibited specimens of *Trichina spiralis* in muscle.

Papers.—"Description of a Disturbed Area of Cainozoic Rocks in South Australia, with Remarks on its Geological Significance," by W. Howchin, F.G.S. Mr. E. V. Clark, B.Sc., the original discoverer of this area, made some remarks on the subject. "Note on the Occurrence of *Trichina spiralis* in South Australia," by E. A. Johnson, M.D. This important parasite occurring in the human muscular tissue has (according to the author) been recorded only three times in Australia.

Ordinary Meeting, May 2, 1911.

The President (J. C. Verco, M.D., F.R.C.S.) in the chair.

A motion was brought forward to alter the evening of meeting from the first Tuesday to the second Thursday in the month. This was sent as a recommendation to the Council.

Exhibits.—Mr. E. Ashby exhibited birds from Anson Bay, Northern Territory, and from Mannum, River Murray, South Australia. Those from the former place included *Ptilinopus ewing*, *Pitta iris*, *Graucalus mentalis*, *Chalcophaps occidentalis*, *Chibia bracteata*, *Peizorhynchus nitidus*, *Rhiphidura isura*, *R. concinna*, and *R. fulvifrons*, as well as several honey-eaters. Mr. Howchin exhibited foraminifera from Rottnest Island, collected by Dr. Verco. He remarked that one of these, *Orbitolites complanata*, has a diameter of from ½ in. to ¾ in. in tropical seas. It used to live in our gulfs and is found sub-fossil in the Port River beds. It also occurs in the Miocene at Hallett Cove, reaching nearly 1 in. in diameter. Mr. Howchin also exhibited photographs of granite boulders from Palmer, South Australia, showing the nature of weathering in granite, and described how the Cornish tors and cheese rings are formed by the weathering of the rock into boulders. Mr. J. G. O. Tepper exhibited photographs and specimens of metamorphic rocks obtained at Barossa, South Australia. Mr. H. G. Smith, F.G.S.,, Assistant Curator and Chemist at the Technological Museum, Sydney, and joint-author of the "Eucalypts of Australia," made some remarks on the economic value of eucalypts. He stated that many tons of terpene oils were being used weekly in the separation of sulphide ores. For medicinal purposes alone the extraction of eucalyptus oils would never become a great industry. At present the medicinal eucalyptus oil trade is about £50,000 yearly. Mr. Smith discussed the venation of the leaves of eucalypts as an indication of their qualitative oil content, and pointed out that there were three main groups, and nearly all eucalypts could be placed in one or other of these groups. The leaf venation and chemical constitution of the oil could be correlated. Professor Rennie,

D.Sc., remarked on the importance of technological work by competent men which has up to the present time not been recognized by our Governments.

ORDINARY MEETING, JUNE 8, 1911.

At the invitation of the Board of Governors of the Public Library, Museum, and Art Gallery the Fellows met in the lecture-room of the Institute to witness the exhibition of slides entitled "Native Ceremonies and Customs of Central Australian Aborigines," prepared by Mr. F. J. Gillen and described and explained by Prof. E. C. Stirling, M.D., F.R.S.

ORDINARY MEETING, JULY 12, 1911.

PROFESSOR RENNIE, D.Sc., in the chair.

NOMINATIONS.—E. Brown, M.B. (Melbourne), D.Ph. (Cambridge); B. S. Roach, editor, Education Department, Adelaide; W. H. Hughes, pastoralist, Gladstone; and H. H. Dutton, pastoralist, Anlaby.

EXHIBITS.—Mr. A. M. LEA, F.E.S., exhibited several rare and interesting insects, including *Hysteridæ* and *Pselaphidæ* from the nests of ants; also a new genus and species of *Leucanidæ* from North Queensland.

PAPERS.—"Additions to the Flora of South Australia," by J. M. BLACK. Mr. BLACK remarked on the importance of notifying the date and place at which alien plants are first observed. "A Preliminary Report on the Discovery of Native Remains at Swanport, River Murray, South Australia, with an Inquiry into the Alleged Occurrence of a Pandemic among the Australian Aborigines," by E. C. STIRLING, M.D., F.R.S.

ORDINARY MEETING, AUGUST 10, 1911.

ELECTIONS.—E. Brown, M.B. (Melbourne), D.Ph. (Cambridge); B. S. Roach, editor, Education Department, Adelaide; H. H. Dutton, pastoralist, Anlaby; and W. H. Hughes, pastoralist, Gladstone, were elected Fellows.

NOMINATIONS.—H. R. Gillespie, carpenter, Adelaide, as a Fellow.

EXHIBITS.—Mr. A. M. LEA, F.E.S., exhibited stag beetles from various parts of Australia, notably *Neolamprima mandibularis* and numbers of the extensive Tasmanian genus *Lyssotes*, also various forms of blind beetles from ant-nests. Mr. EDQUIST exhibited specimens of saltbushes grown on the Adelaide Plains from cuttings received from the north. Mr. W. HOWCHIN, F.G.S., exhibited pseudo-meteorites which he said were sandy concretions consolidated by bush fires. He had found similar concretions in the fire circles of native camps,

and the Elder expedition had brought back some specimens which were labelled "Calcined Sand from the Hollows of Burnt Trees." The interest attaching to these objects was that many people thought they were meteorites.

Papers.—"Notes Descriptive of a Stereogram of the Mount Lofty Ranges," by W. N. Benson, B.Sc. This was communicated by Mr. W. Howchin, F.G.S., who remarked that the present elevations of the Mount Lofty Ranges were geologically modern, instead of very ancient as was formerly believed. The new physiography was proving extremely valuable as a means of interpreting changes in earth movements and physical contours. "Revision of the Australian Hesperiadæ," by O. B. Lower, F.L.S., F.E.S.

Ordinary Meeting, September 14, 1911

The President (J. C. Verco, M.D., F.R.C S.) in the chair.

Election.—H. R. Gillespie, carpenter, South Terrace, Adelaide, was elected a Fellow.

Exhibits.—Mr. J. G. O. Tepper, F.L.S., exhibited some very minute scale insects from *Callitris verrucosa*, growing near Lyndoch Valley. Although too immature for certain identification it is probably *Fiorina camellæ*, described by Maskell, in 1897, from China. Mr. A. M. Lea exhibited two species of the tsetse-fly:—(1) *Glossina morsitans*, which attacks horses and not man: (2) *G. palpalis*, which attacks man and is the carrier for the trypanosome of sleeping-sickness. Mr. Lea mentioned that a closely-allied fly (*Stomorys calcitrans*) is found in Australia. It has been asserted but not proved that this insect acts as an anthrax-carrier. Mr. W. Howchin, F.G.S., exhibited a specimen of Miocene sandstone thickly studded with fossil shells (chiefly *Pecten antiaustralis*), obtained from an excavation at the Bank of New South Wales, North Terrace; also samples of an old fresh-water deposit containing numerous shells, laid down in a former lake area now forming a river terrace 15 ft. above the present level of the River Broughton, near Koolunga.

Paper.—"Notes on the Cambrian Glacial Beds of South Australia," by F. Noetling, M.A., Ph.D., communicated by the Honorary Secretary.

Annual Meeting, October 12, 1911.

The President (J. C. Verco, M.D., F.R.C.S.) in the chair.

The annual report and balance-sheet were read and adopted.

ELECTION OF OFFICERS.—*President*, J. C. Verco, M.D., F.R.C.S.; *Vice-Presidents*, Professor Rennie, D.Sc., and Walter Rutt, C.E.; *Members of Council*, Walter Howchin, F.G.S., and Edwin Ashby; *Hon. Treasurer*, W. B. Poole; *Auditors*, J. S. Lloyd and Howard Whitbread. A vote of thanks was passed to the President and Council on the motion of Dr. TORR.

EXHIBITS.—Mr. S. DIXON exhibited a new *Orobanche* from Brighton. Mr. Black considered it is allied to *Orobanche ramosa*, and offered to send it to Kew for further identification. Mr. W. HOWCHIN exhibited a pseudo-meteorite sent from Mount Gambier. It appeared to be a quartzite, perfectly round, and has a ferruginous coating. Mr. SELWAY drew the attention of the meeting to the weathering of the well-known glacial surface exposed at Hallett Cove. Dr. TORR suggested that the matter be referred to the Council for consideration, with the view of taking some steps by which this interesting natural feature may be preserved from decay.

PAPERS.—"Australian Curculionidæ, Part IX.," by A. M. LEA, F.E.S.; "Studies in Australian Coleoptera, Part XLI.," by Rev. T. BLACKBURN, B.A.; "Western Australian Polyplacophora," by Dr. TORR; "Notes on Some Species of the Isopod Family, Sphæromidæ, from South Australia, Part III.," by W. H. BAKER; and "Notes on Marine Mollusca of South Australia, Part XIV.," by J. C. VERCO, M.D., F.R.C.S.

THE EDITOR reported the publication of Memoir, part iii., vol. ii., on "Chiastolites from Bimbowrie," by D. MAWSON, D.Sc.

The proposed discussion "On the Importance of Investigating the Influence of Metallic Minerals on Vegetation," which was to have been opened by Mr. S. DIXON, was postponed on account of the lateness of the hour.

ANNUAL REPORT, 1910-11.

The Council has the pleasure to report that during the past year the scientific contributions, especially in geology and biology, have been many and important.

Five new Fellows have been elected and one old one reinstated, while two have resigned, one owing to leaving the State, the other from advancing age and inability to attend the meetings. Professor Bragg was elected an Honorary Fellow of the Society, and in his acknowledgment heartily

thanked our Society for the honour conferred on him. The arrival of one of our members and frequent contributor, Mr. A. M. Lea, F.E S., from Tasmania, to fill a position in the South Australian Museum will give a stimulus to entomology and natural history generally in the State.

Dr Verco has continued his series of papers on the marine mullusca of South Australia in part xiv. Geological contributions have been submitted by Mr. W. Howchin, F G.S., and Dr. D. Mawson, as well as a short paper on a stereogram of the Mount Lofty Ranges by Mr. Noel Benson, B.Sc. Mr. A. M. Lea, F.E.S., and Canon Blackburn have written on the Coleoptera, while Mr. O B. Lower has contributed a voluminous paper on a section of Lepidoptera.

Botanical science is richer for papers by Mr. J. M. Black, who has indefatigably followed the invasion of our State by alien plants and registered their localities of appearance.

Dr. E C. Stirling has contributed a report of great historical and ethnological value, and of special interest to students in our own State.

A considerable number of interesting birds and insects, as well as plants and geological specimens, has been submitted at the meetings, and it is hoped that exhibits will be increasingly shown, as the discussions on them are very interesting to Fellows who may not be able to follow the more technical contributions.

During the year the Fauna and Flora Committee of this Society opened a campaign to advance the securing of a larger area on Kangaroo Island. Having obtained the support of all the Australasian Scientific Societies of note and the aid of some influential public men the Committee met the Commissioner of Crown Lands in deputation. The proceedings of the deputation were marked by enthusiastic utterances on the part of its members, and a promise was obtained from the Commissioner that all that was possible of the 300 square miles asked for would be secured for the reserve at the earliest possible date. The veteran workers Messrs. S. Dixon and Symonds Clark, with Mr. E. Ashby, had much to do with the success of the deputation.

The Library is in process of being catalogued under the Dewey card system by Mr. Clucas and his assistant. In order to classify the Library and make provision for additions tenders have been accepted for two bookstacks. For various reasons the binding of publications has been in abeyance, but it is hoped that during the coming year much will be done in this direction. During the year the Editor presented part iii.,

vol. ii., of the Memoirs, being a monograph on Chiastolites by Dr. Douglas Mawson.

The important scientific matter printed in the Society's Transactions continues to cause a demand for the publication, and several new exchanges have been arranged for.

The membership of the Society comprises 9 Honorary Fellows, 5 Corresponding Members, 69 Fellows, and 1 Associate.

J. C. Verco, *President.*

Robert Pulleine, *Hon. Secretary.*

ROYAL SOCIETY OF SOUTH AUSTRALIA (INCORPORATED).

Revenue and Expenditure for 1910-11.

Cr.	£	s.	d.	£	s.	d.
To Balance, October 1, 1910 ...				535	2	7
,, Subscriptions—						
Royal Society	71	13	0			
Field Naturalists' Section ...	17	12	6			
Malacological Section	1	7	6			
Microscopical Section	5	17	6			
				96	10	6
,, Grants from Government—						
On Subscriptions .. .	76	6	3			
For Printing Reports on Scientific Investigations in South Australia	150	0	0			
				226	6	3
,, Sale of Transactions				1	4	8
,, Donations and Interest—						
Donations	75	0	0			
Interest on S.A. Government Stock	75	0	0			
Interest at Savings Bank ..	10	19	9			
				160	19	9
				£1,020	3	9

Dr.	£	s.	d.	£	s.	d.
By Transactions—						
Printing	106	19	11			
Illustrating	81	7	6			
Publishing	0	15	6			
				189	2	11
,, Memoirs—						
Printing	18	15	0			
Illustrating	54	10	6			
Publishing	1	12	11			
				74	18	5
,, Grants—						
Field Naturalists' Section ...	7	0	0			
Field Naturalists' Section—Special Grant on account Fauna and Flora Protection Committee	7	13	6			
Microscopical Section	5	17	6			
				20	11	0
,, Library—						
New Shelving and Binding Books	20	3	0			
Carriage of Books	0	6	0			
Cataloguing	8	3	6			
				28	12	6
,, Caretaking and Lighting ...	15	1	6			
,, Printing, Stationery, and Postage	6	15	2			
,, Advertising	1	9	2			
,, Bank Account Charge	0	10	0			
				23	15	10
,, Transfer to Endowment Fund ...				150	0	0
,, Balance, September 30, 1911 ...				533	3	1
				£1,020	3	9

Examined and found correct—
J. S. Lloyd,
Howard Whitbread, } Hon. Auditors.

W. B. Poole, Hon. Treasurer.

September 30, 1911.

ENDOWMENT FUND.

	£	s.	d.		£	s.	d.
To Amount of Fund, October 1, 1910	2,006	0	0	By £2,000 S.A. 3½ per cent. Inscribed Stock	1,997	10	0
,, Amount transferred from Revenue and Expenditure Account	150	0	0	,, Deposit in Savings Bank	158	10	0
	£2,156	0	0		£2,156	0	0

Examined and found correct—
J. S. LLOYD,
HOWARD WHITBREAD, } Hon. Auditors.
September 30, 1911.

W. B. POOLE, Hon. Treasurer

MALACOLOGICAL SECTION

OF THE

Royal Society of South Australia (Incorporated).

ANNUAL REPORT FOR THE YEAR 1910-11.

Nine meetings were held during the past year, at which the average attendance was six. There are now thirteen members on the roll.

The chief work of the year comprised a revision of South Australian mollusca.

F. R. ZIETZ, *Hon. Sec. and Treas*

RECEIPTS AND EXPENDITURE FOR THE YEAR 1910-11.

Receipts.	£	s.	d.	Expenditure.	£	s.	d.
To Credit Balance	0	13	10	By Postages	0	6	5
, Subscriptions	1	7	6	,, Unbehaun & Johnstone, Limited .	0	3	0
				,, Subscriptions to Royal Society	1	7	6
				,, Balance in hand	0	4	5

DONATIONS TO THE LIBRARY

FOR THE YEAR 1910-11.

TRANSACTIONS, JOURNALS, REPORTS, ETC.,

presented by the respective Editors, Societies, and Governments.

AUSTRALIA.

AUSTRALIA. *Bureau of Census and Statistics.* Official year book, no. 4, 1901-10. Melb. 1911.

AUSTRALIA. *Bureau of Meteorology.* Bulletin, 6-8. 1911.

——— ——— Maps: average rainfall map of Victoria. 1910.

——— ——— Monthly report, vol. 1, no. 2-11. 1910-11.

——— ——— Rainfall map for 1910.

——— ——— Rain and river observations in New South Wales, 1903-1908.

AUSTRALIA. *Department of Trade and Customs.* Second report by the Director on fishing experiments carried out by the *F.I.S. Endeavour*, Sept., 1909, to Oct., 1910. Melb. 1911.

ROYAL ANTHROPOLOGICAL SOCIETY OF AUSTRALIA. Journal: Science of man, vol. 12, no. 5-12; vol. 13, no. 1-6. Syd. 1910-11.

NEW SOUTH WALES.

AGRICULTURAL GAZETTE OF NEW SOUTH WALES, vol 21, pt. 9-12 and index; vol. 22, pt. 1-8. Syd.

AUSTRALIAN MUSEUM. Memoir 4, pt.13-15. Syd. 1911.

——— Records, vol. 8, pt. 1-2. Syd. 1911.

——— Report of the trustees, to June, 1910. Syd.

——— Special catalogue, vol. 3, pt. 1-3. Syd. 1911.

LINNEAN SOCIETY OF NEW SOUTH WALES. Abstract of proceedings, no. 286-293. Syd. 1910-11.

——— Proceedings, vol. 35, pt. 3; vol. 36, pt. 1. Syd. 1910-11.

MAIDEN, J. H. Forest flora of New South Wales, vol. 4, pt. 10; vol. 5, pt. 1-5. Syd. 1910-11.

——— Critical revision of the genus eucalyptus, pt. 12-13. Syd. 1910-11.

NEW SOUTH WALES. *Board of Fisheries.* Report on the fisheries of New South Wales for 1909. Syd. 1910.

——— Brief review of the fisheries of New South Wales, present and potential. Syd. 1910.

NEW SOUTH WALES. *Botanical Gardens and Government Domains.* Report of the director, 1909. Syd. 1910.

NEW SOUTH WALES. *Department of Mines.* Annual report, 1910. Syd. 1911.

NEW SOUTH WALES NATURALISTS' CLUB. Journal: The Australian naturalist, vol. 2, pt. 4-8. Syd. 1911.

PUBLIC LIBRARY OF NEW SOUTH WALES. Report, 1910. Syd. 1911.

ROYAL SOCIETY OF NEW SOUTH WALES. Journal and proceedings, vol. 42; vol. 43, pt. 1-4; vol. 44, pt. 1-3. Syd. 1910.

SYDNEY UNIVERSITY. Calendar, 1911. Syd. 1911.

QUEENSLAND.

QUEENSLAND. *Department of Mines.* Geological Survey publications, no. 222, 231-2, 234. Brisb. 1910-11.

ROYAL SOCIETY OF QUEENSLAND. Proceedings, vol. 8, pt. 2; vol. 16, pt. 1-2; vol. 23, pt. 1. Brisb.

SOUTH AUSTRALIA.

PUBLIC LIBRARY, MUSEUM, AND ART GALLERY OF SOUTH AUSTRALIA. Report of the Board of Governors, 1909-10. Adel. 1910.

SOUTH AUSTRALIA. *Department of Mines.* Review of mining operations, no. 12. Adel. 1910.

SOUTH AUSTRALIA. *Northern Territory* Government Geologist's report on the Tanami goldfields and district. Adel. 1911.

SOUTH AUSTRALIAN SCHOOL OF MINES AND INDUSTRIES AND TECHNOLOGICAL MUSEUM. Annual report, 1909. Adel. 1910.

SOUTH AUSTRALIA. *Woods and Forests Department.* Annual progress report, 1909-10. Adel. 1910.

TASMANIA.

ROYAL SOCIETY OF TASMANIA. Papers and proceedings, 1910. Hobart.

TASMANIA. *Department of Mines.* Progress of the mineral industry of Tasmania, Sept., 1910; Dec., 1910; March, 1911; June, 1911. Hobart. 1911.

——— *Geological Survey.* Bulletin, no. 8. Hobart. 1911

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ROYAL SOCIETY OF VICTORIA. Proceedings, new ser., vol. 23, no. 1-2. Melb. 1910-11.

VICTORIA. *Department of Agriculture.* Journal, vol. 8, pt. 10-12; vol. 9, pt. 1-11. Melb. 1910-11

——— Report, 1907-10. Melb. 1910.

VICTORIA. *Department of Mines.* Annual report of the Secretary for Mines, 1910. Melb. 1911.
VICTORIAN NATURALIST, vol 27, no. 6-12; vol. 28, no. 1-7. Melb. 1910-11.
VICTORIAN YEAR BOOK. vol. 30, 1909-10. Melb. n.d.

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WESTERN AUSTRALIA. *Geological Survey.* Bulletin, no. 38, 39, 41. Perth 1910-11.

ENGLAND.

BRITISH ANTARCTIC EXPEDITION, 1907-09. Report on the scientific investigations, vol. 1, pt. 5-6; vol. 2, pt. 1-4. Lond. 1910-11.
CAMBRIDGE PHILOSOPHICAL SOCIETY. Proceedings, vol. 15, pt. 6; vol. 16, pt. 1-2. Camb. 1910-11.
CAMBRIDGE UNIVERSITY LIBRARY. Report of the Library Syndicate, 1910. Camb. 1911.
CONCHOLOGICAL SOCIETY. Journal of conchology, vol. 13, pt. 4-8. Lond. 1910-11.
ENTOMOLOGICAL SOCIETY OF LONDON. Transactions, 1910. Lond. 1911.
IMPERIAL INSTITUTE. Bulletin, vol. 8, no. 4; vol. 9, no. 1-2. Lond. 1910-11.
LINNEAN SOCIETY. List, 1910-11. Lond. 1911.
——— Proceedings, Oct., 1910. Lond. 1910.
LIVERPOOL BIOLOGICAL SOCIETY. Proceedings and transactions, vol. 24. L'pool. 1910.
MANCHESTER FIELD NATURALISTS' AND ARCHAEOLOGISTS' SOCIETY. Report and proceedings, vol. 50. Manch. 1911.
MANCHESTER LITERARY AND PHILOSOPHICAL SOCIETY. Memoirs and proceedings, vol. 54, pt. 3; vol. 55, pt. 1-2. Manch. 1910-11.
NATIONAL PHYSICAL LABORATORY. Collected researches, vol. 7. Teddington. 1911.
——— Report, 1910. Teddington. 1911.
ROYAL BOTANICAL GARDENS, KEW. Bulletin, 1910. Lond. 1910.
ROYAL MICROSCOPICAL SOCIETY OF LONDON. Journal, 1910, pt. 4-6; 1911, pt. 1-3. Lond. 1910-11.
ROYAL SOCIETY OF LONDON. Proceedings, ser. A, no. 570-581. Lond. 1910-11.
——— ——— Ser. B, no. 559-571. Lond. 1910-11.
UNITED EMPIRE, new ser., vol. 1, no. 1-12; vol. 2, no. 1-10. Lond. 1910-11.

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Belfast Natural History and Philosophical Society. Report and proceedings, session 1909-10. Belfast. 1911.

Royal Dublin Society. Economic proceedings, vol. 2, no. 2. Dublin. 1910.

——— Scientific proceedings, new ser., vol. 12, no. 30-37; t.p. and index to vol. 12; vol. 13, no. 1-10. Dublin. 1910-11.

Royal Irish Academy. Proceedings: Section A, vol. 28, no. 3; t.p. and index to vol. 28; vol. 29, no. 1-4. Dublin. 1910-11.

——— ——— Section B, vol. 28, no. 7-8 and index to vol. 28; vol. 29, no. 1-6. Dublin. 1910-11.

——— ——— Section C, vol. 28, no. 7-12; t.p. and index to vol 28; vol. 29, no. 1-4. Dublin. 1910-11.

SCOTLAND.

Edinburgh Geological Society. Transactions, vol. 9, no. 5. Edin. 1910.

Glasgow Geological Society. Transactions, vol 14, pt. 1. Glasg. 1910.

Royal Physical Society for the Promotion of Zoology, etc. Proceedings, vol. 18, no. 3. Edin. 1911.

Royal Society of Edinburgh. Proceedings, vol 30, pt. 7; vol. 31, pt 1-4. Edin. 1910-11.

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Kaiserliche Akademie der Wissenschaften. Anzeiger, Jahrg. 47. Wien. 1911.

K.k. Geologische Reichanstalt. Verhandlungen, Jahrg. 1910, Nr. 2-18; Jahrg. 1911, Nr. 1-11. Wien. 1910-11.

K.k. Naturhistorisches Hofmuseum. Annalen, Bd. 23, Nr. 3-4; Bd. 24, Nr. 1-2. Wien. 1910.

K.k. Zoologische-Botanische Gesellschaft. Verhandlungen, Bd. 60, H. 4-8; Bd. 61, H. 1-5. Wien. 1910-11.

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Belgique, Musee Royal D'Histoire Naturelle. Extrait des Mémoires, année, 1907, tom. 4-5; année, 1908, tom. 4-5. Brux. 1910-11.

Belgique Societe Royal de Botanique. Bulletin, tom. 47, fasc. 1-4. Brux. 1910-11.

Bruxelles Jardin Botanique de L'Etat. Bulletin, vol. 3, fasc. 1. Brux. 1911.

OBSERVATOIRE ROYAL DE BELGIQUE, L'. Annales, n.s.: Annales astronomiques, tom. 2, fasc. 2. Brux.
—— Annuaire astronomique, 1911. Brux 1910.
SOCIETE ENTOMOLOGIQUE DE BELGIQUE. Annales, tom. 53. Brux. 1909.
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BRAZIL.

BRAZILIANISCHE RUNDSCHAU, Jahrg. 1, Heft 1. Rio de Janeiro. 1910.
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RIO DE JANEIRO INSTITUTO OSWALDO CRUZ. Memorias, tom. 2, fasc. 1-2. Rio de Janeiro. 1910.
RIO DE JANEIRO, OBSERVATORIO DE. Boletin mensal, Jan.-Dec., 1908. Rio de Janeiro. 1909.
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CANADA. *Department of Mines. Geological Survey Branch.* Memoirs, no. 1-6, 8, 10, 11-T, 12, 14. Ottawa.
—— —— —— Report, 1064, 1066. Ottawa. 1911.
—— —— —— Summary report, 1910. Ottawa. 1911.
—— —— *Mines Branch.* Bulletin, no. 3-5 Ottawa. 1911.
—— —— —— Report, 59, 69, 88. Ottawa. 1910-11.
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CAPE COLONY.

ALBANY MUSEUM. Records, vol. 2, pt. 3. Grahamstown. 1911.
ROYAL SOCIETY OF SOUTH AFRICA. Transactions, vol. 2, pt. 1-2. Cape Town. 1910-11.
SOUTH AFRICAN JOURNAL OF SCIENCE, vol. 6, pt. 11-12; vol. 7, pt. 1-7. Cape Town. 1910-11.
SOUTH AFRICAN MUSEUM. Annals, vol. 5, pt. 8-9; vol. 6, pt. 4; vol. 7, pt. 4; vol. 8, pt. 1; vol. 9, pt. 1; vol. 10, pt. 1; vol. 11, pt. 1. Cape Town.

FRANCE.

FEUILLE DES JEUNES NATURALISTES, nos. 479-92. Par. 1910-11.
NANTES. SOCIETE DES SCIENCES NATURELLES DE L'OUEST DE LA FRANCE. Bulletin, tom. 9, trimestre 2-4; tom. 10, trimestre 1-2. Nantes. 1910-11.

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SOCIETE LINNEENNE DE NORMANDIE. Bulletin, 6e sér., vol. 2. Caen. 1910.

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LIST OF FELLOWS, MEMBERS,

ETC.,

OCTOBER, 1911.

Those marked with an asterisk have contributed papers published in the Society's Transactions.

Any change in address should be notified to the Secretary.

NOTE.—The publications of the Society will not be sent to those whose subscriptions are in arrears.

Date of Election

HONORARY FELLOWS.

1910. *BRAGG, W. H., M.A., F.R.S., Professor of Physics, Univer- of Leeds, England.
1893. *COSSMAN, M., Rue de Maubeuge, 95, Paris.
1897. *DAVID, T. W. EDGEWORTH, C.M.G., B.A., D.Sc., F.R.S., Professor of Geology, University of Sydney.
1890. *ETHERIDGE, ROBERT, Director of the Australian Museum of New South Wales, Sydney.
1905. GILL, THOMAS, I.S.O., Under-Treasurer, Adelaide.
1905. *HEDLEY, CHAS. H., Naturalist, Australian Museum, Sydney.
1892. *MAIDEN, J. H., F.L.S., F.C.S., Director Botanic Gardens, Sydney, New South Wales.
1898. *MEYRICK, E. T., B.A., F.R.S., F.Z.S., Thornhanger, Marlborough, Wilts, England.
1894. *WILSON, J. T., M.D., Professor of Anatomy, University of Sydney.

CORRESPONDING MEMBERS.

1881. BAILEY, F. M., F.L.S., Colonial Botanist, Brisbane, Queensland.
1880. *FOELSCHE, PAUL, Inspector of Police, Palmerston, Northern Territory.
1893. STRETTON, W. G., Palmerston, Northern Territory.
1905. THOMSON, G. M., F.L.S., F.C.S., Dunedin, New Zealand.
1908. *WOOLNOUGH, WALTER GEORGE, D.Sc., F.G.S., Lecturer in Geology, University of Sydney. (Fellow from 1902.)

FELLOWS.

1895. *ASHBY, EDWIN, Royal Exchange, Adelaide.
1902. *BAKER, W. H., F.L.S., Glen Osmond Road, Parkside.
1908. *BENSON, W. NOEL, B.Sc., University of Sydney.
1907. *BLACK, J. MCCONNELL, Alfred Street, Norwood.
1887. *BLACKBURN, Rev. Canon THOMAS, B.A., Woodville.
1909. BRADLEY, EDGAR J., Civil Engineer, Hydraulic Engineer's Department, Adelaide.
1911. BROWN, EDGAR J., M.B., D.Ph. (Cambridge), 3, North Terrace, Adelaide.
1883. BROWN, H. Y. L., F.G.S., late Government Geologist, Adelaide.
1893. BRUMMITT, ROBERT, M.R.C.S., Medindie.
1904. BRUNSKILL, GEORGE, Semaphore, South Australia.

1906. BUNDEY, MISS ELLEN MILNE, 148, Molesworth Street, North Adelaide.
1907. *CHAPMAN, R. W., M.A., B.C.E., Professor of Mathematics and Mechanics, University of Adelaide.
1904. CHRISTIE, W., Rundle Street, Adelaide.
1910. *CLARK, E. V., B.Sc., Lecturer in Electrical Engineering, University of Adelaide.
1867. CLARK, M. SYMONDS, Bunyip Buildings, Gawler Place, Adelaide.
1879. *CLELAND, W. L., M.B., Ch.M., J.P., Colonial Surgeon, Resident Medical Officer Parkside Lunatic Asylum, Lecturer in Materia Medica, University of Adelaide.
1895. CLELAND, JOHN B., M.D., Government Bureau of Microbiology, Sydney, New South Wales.
1907. *COOKE, T. W., D.Sc., Lecturer, University of Adelaide.
1907. DARLING, JOHN, Kent Terrace, Norwood.
1887. *DIXON, SAMUEL, Bath Street, New Glenelg.
1911. DUTTON, H. H., Anlaby.
1902. EDQUIST, A. G., Tate Terrace, Croydon.
1911. GILLESPIE, H. R., South Terrace, Adelaide.
1904. GORDON, DAVID, Gawler Place, Adelaide.
1880. *GOYDER, GEORGE, A.M., F.C.S., Analyst and Assayer, Adelaide.
1910. GRANT, KERR, Professor of Physics, University of Adelaide.
1904. GRIFFITH, H., Henley Beach.
1896. HAWKER, E. W., F.C.S., Calcanina, Clare (Eagle Chambers, Adelaide).
1891. *HOLTZE, MAURICE, F.L.S., Director Botanic Gardens, Adelaide.
1883. *HOWCHIN, WALTER, F.G.S., Lecturer in Geology and Palæontology, University of Adelaide.
1911. HUGHES, W. H., Booyoolie, Gladstone.
1893. JAMES, THOMAS, M.R.C.S., Moonta.
1910. *JOHNSON, E. A., M.D., M.R.C.S., Franklin Street, Adelaide.
1897. *LEA, A.M., F.E.S., South Australian Museum, Adelaide.
1884. LENDON, A. A., M.D. (Lond.), M.R.C.S., Lecturer in Forensic Medicine and in Chemical Medicine, University of Adelaide, and Hon. Physician, Children's Hospital, North Adelaide.
1856. LLOYD, J. S., Alma Chambers, Adelaide.
1888. *LOWER, OSWALD B., F.E.S. (Lond.), Broken Hill, New South Wales.
1905. *MAWSON, DOUGLAS, B.Sc., B.E., Lecturer in Mineralogy and Petrology, University, Adelaide.
1874. MAYO, GEO. G., C.E., 116, Franklin Street, Adelaide.
1907. MELROSE, ROBERT THOMSON, Mount Pleasant.
1897. *MORGAN, A. M., M.B., Ch.B., Angas Street, Adelaide.
1907. MUECKE, HUGO, C.E., Grenfell Street, Adelaide.
1884. MUNTON, H. S., North Terrace, Adelaide.
1886. POOLE, W. B. (Hon. Treasurer), Savings Bank, Adelaide.
1908. POPE, WILLIAM, Solicitor, Adelaide.
1907. PULLEINE, R. H., M.B. (Hon. Secretary), North Terrace, Adelaide.
1907. PURDUE, R. F., Mining Agent, St. Helen's, Tasmania.
1885. *RENNIE, EDWARD H., M.A., D.Sc. (Lond.), F.C.S., Professor of Chemistry, University of Adelaide.

1911. Roach, B. S., Education Department, Flinders Street, Adelaide.
1905. *Rogers, R. S., M.A., M.D., Flinders Street, Adelaide.
1869. *Rutt, Walter, Chief Assistant Engineer, Adelaide.
1891. Selway, W. H., Treasury, Adelaide.
1893. Simson, Augustus, Launceston, Tasmania.
1871. Smith, Robert Barr, Adelaide.
1906. Snow, Francis H., Adelaide.
1910. *Stanley, E. R., University, Adelaide.
1881. *Stirling, Edward C., C.M.G., M.A., M.D., F.R.S., F.R.C.S., Professor of Physiology, University of Adelaide, Director of South Australian Museum.
1907. Sweetapple, H. A., M.D., Park Terrace, Parkside.
1904. Taylor, William, St. Andrew's, North Adelaide.
1886. *Tepper, J. G. O., F.L.S., Elizabeth Street, Norwood. (Corresponding Member since 1878.)
1897. *Torr, W. G., LL.D., M.A., B.C.L., Brighton, South Australia.
1894. *Turner, A. Jefferis, M.D., Wickham Terrace, Brisbane, Queensland.
1889. Vardon, Senator Joseph, J.P., Gresham Street, Adelaide.
1878. *Verco, Joseph C., M.D., F.R.C.S., Lecturer on the Principles and Practice of Medicine and Therapeutics, University of Adelaide.
1883. Wainwright, E. H., B.Sc. (Lond.), McLaren Vale.
1878. Ware, W. L., J.P., Adelaide.
1859. Way, Right Hon. Sir Samuel James, Bart., P.C., D.C.L., Chief Justice and Lieutenant-Governor of South Australia, Adelaide.
1907. Webb, Noel A., Barrister, Waymouth Street, Adelaide.
1904. Whitbread, Howard, Currie Street, Adelaide.

Associate.

1904. Robinson, Mrs. H. R., "Las Conchas," Largs Bay, South Australia.

APPENDICES.

FIELD NATURALISTS' SECTION

OF THE

Royal Society of South Australia (Incorporated).

TWENTY-EIGHTH ANNUAL REPORT OF THE COMMITTEE

For the Year Ended September 19, 1911

The monthly meetings and the excursions held during the past twelve months may be considered fairly as equal in work and interest to any that have gone before. The membership has increased, and it may be mentioned with much satisfaction that among those who have joined are several who belong to the teaching profession. Such additions to the roll are particularly welcome as adding strength to the practical workers in natural history. Worthy of note, too, is the addition to the roll of the name of Mr. A. M. Lea, whose reputation as a naturalist preceded his advent to South Australia, and whose activities in the field of science will no doubt be of much service to the Section.

Meetings.

At the last annual meeting the Chairman (Mr. W. H Selway) continued his review of "The National Parks and Forests of Australia." This second part of his review, like the first, was a valuable record of the work that was being achieved in the direction of conserving tracts of country for the preservation of Australian flora and fauna, and for holding in reserve areas of land for the benefit of the people, as a whole, against the rapid strides of settlement for agricultural, pastoral, and other means of production from the land. It is gratifying to know that this review has been printed in pamphlet form and is thus retained as a valuable record for future reference.

Following upon this, as showing the active interest that the Section has always evinced in the subject, Mr. Walter Gill, F.L.S., was requested to deliver an address on "Forestry

in South Australia." This was given with illustrated views, and Mr. Gill's enthusiasm in his work as Conservator of Forests showed how closely his life-work was bound up with this important industry.

On May 16 Mr. J W. Mellor delivered a lecture on his visit to the Capricorn Group of Islands, on the Great Barrier Reef, north-west coast of Queensland. The visit was made in connection with the Congress of the Ornithological Union held last year. Mr. Mellor's address was full of interest in bringing under notice the life history of the birds, as well as the marine zoology and plant growth new to those who have not had the opportunity of visiting the places referred to. Many specimens collected on the trip were shown and described.

Following upon this lecture Captain S. A. White, who was also with the same party, gave an interesting address, illustrated by numerous views of the life and habits of the birds that live on and frequent the coastal islands of Queensland.

Members, having caught on to the charm of travels abroad, next requested Dr. R. S Rogers to give some information regarding the natural history and other phases of life in Africa. This lecture proved equally fascinating, as by the aid of lantern views Dr. Rogers described a journey he and Mrs. Rogers took through Natal during the progress of the Boer war. These observant naturalists were able to describe many matters of interest in the fauna and flora, as well as adventures peculiar to the stirring times of war.

Exhibits.

While natural history abroad was of absorbing interest objects nearer home were not neglected, and the next meeting was devoted to the description of exhibits. Mr. A. M. Lea showed a case of beetles, Dr. Pulleine a collection of spiders, Mr. Elkan a specimen of micaceous ironstone from near Paradise, Mr. J. F. Mellor leaves, pods, and seeds of a Queensland *Stottea*, Miss Phillipson a ball of kauri-gum from New Zealand, and Mr. Stokes chitons, spiders, and land shells. The exhibits were described and commented upon by the exhibitors and others, and a profitable meeting was held. At most of the evening meetings exhibits have proved an interesting and instructive feature.

Excursions.

The field work for the year has maintained its usual interest, but the attendance at the engagements has been somewhat spasmodic. Some have been poorly attended, while others have drawn the largest attendances for many years.

This is accounted for by the excursions having been arranged during the winter months and the variableness of the weather. Following is a list of the engagements:—October 29, 1910, National Park; November 12, Houghton; December 10, Mount Lofty; March 17, 1911, Adelaide Observatory; May 5, Adelaide Observatory; May 6, Upper Sturt; May 20, Brighton; July 22, Norton Summit; August 5, Aldgate to Mount Lofty; September 2, Eden Hills.

Robert Pulleine, *Chairman.*

E. H. Lock, *Hon. Secretary.*

TWENTY-THIRD ANNUAL REPORT OF THE NATIVE FAUNA AND FLORA PROTECTION COMMITTEE OF THE FIELD NATURALISTS' SECTION OF THE ROYAL SOCIETY OF SOUTH AUSTRALIA FOR THE YEAR ENDED SEPTEMBER, 1911.

Flinders Chase, Kangaroo Island.

In October last circulars enclosing a reprint of a portion of last year's report were sent to members of Parliament soliciting their support to the movement for more firmly establishing this reserve and extending its area. In November a deputation from the Royal Society waited upon the Commissioner of Crown Lands to urge upon him the necessity for better protection being given to kangaroos, and, as a means towards this end, the completion of the Kangaroo Island reserve. The Commissioner expressed his sympathy and said he would give a reply as soon as possible. In May last your Committee distributed nearly 300 circulars with a plan of the western portion of the island, in response to which a deputation numbering nearly 100 persons, including representatives of the Universities of Adelaide, Sydney, and Melbourne, of the Royal Society and the affiliated Societies, the Australian Natives' Association and many South Australian Societies, the Royal Societies of New South Wales, Victoria, and Tasmania, the Royal Australasian Ornithologists' Union, the Corporations of Adelaide, Brighton, Glenelg, Norwood, Port Adelaide, St. Peters, and Unley, and the District Councils of Burnside, Crafers, Payneham, and Woodville, waited upon the Commissioner of Crown Lands on June 13 to reiterate the requests already made to his predecessors in office and to himself. The Minister received the deputation favourably, and

said he would recommend to the Government that a larger area than the 140 square miles already promised should be granted, but that he desired to inspect the country himself before deciding upon the extent of the additional area. He would also recommend that a sum be placed upon the Estimates for a fence to be put across the island to protect the settlers' crops from the kangaroos.

Protection of Opossums.

Under the existing Game Act there is no power given to transfer animals from the unprotected to the protected list, and consequently no power of establishing a close season for opossums. The Secretary drew up an amending Bill for the purpose of overcoming this difficulty, and this was placed in the hands of the Government.

Birds Protection Act.

The names of several birds have been added to the schedule of those to be wholly protected, among them those mentioned in the last report, comprising bee-eaters, native pheasants, black cockatoos, gang-gang cockatoos, pigeons, doves, and bustards. Efforts are being made to get pelicans again placed on the partially protected list. The close season for the partially protected birds has been extended from December 20 to the middle of January. Your Committee having been asked to furnish the Commissioner of Crown Lands with the amendments to the Birds Protection Act desired by them, a sub-committee was appointed to confer with the President of the Ornithological Association, and a number of suggested amendments have been sent to the Minister. With these passed into law many of the difficulties now experienced in carrying out the obvious intentions of the Act will be overcome.

The members of your Committee note with pleasure the increasingly rapid spread in the community of their views regarding the necessity for protecting our fauna and flora, enunciated by them some twenty-three years ago and since then repeatedly urged upon the public.

Saml. Dixon, *Chairman.*

M. Symonds Clark, *Hon. Secretary.*

September 19, 1911.

FIELD NATURALISTS' SECTION OF THE ROYAL SOCIETY OF SOUTH AUSTRALIA (INCORPORATED).

Statement of Receipts and Expenditure for the Year Ended September 30, 1911.

Dr.	£	s.	d.	Cr.	£	s.	d.
To Balance brought forward	7	3	8	By Postages	5	12	8
,, Grant from the Royal Society	14	13	6	,, Printing	2	13	0
,, Subscriptions	17	12	6	,, Advertising	0	17	5
,, Bank Interest	0	8	1	,, Lecture-room and Lantern	3	1	8
				,, Sundries	1	2	0
				,, Fauna and Flora Committee (printing)	7	13	6
					21	0	3
				,, Subscriptions paid to Royal Society	17	12	6
				,, Balance in Savings Bank	0	16	6
				,, Cash in hand	0	8	6
	£39	17	9		£39	17	9

	£	s.	d.
September 30, 1911—Balance in General Funds	1	5	0
Balance in Excursion Account	3	18	1
	£5	3	1

Audited and found correct,

J. S. Lloyd,
Walter D. Reed, } Auditors.

Adelaide, September 15, 1911.

Stanley S. Stokes, Hon. Treasurer.

APPENDIX.

A FAREWELL ADDRESS TO THE FIELD NATURALISTS' SECTION OF THE ROYAL SOCIETY BY THE CHAIRMAN OF THE NATIVE FAUNA AND FLORA PROTECTION COMMITTEE, S. DIXON.

[Read September 19, 1911.]

After occupying the chair for twenty-three consecutive years it is time to make way for a younger man, and I propose to place before you an outline of what has been accomplished, and what remains to be done to fully accomplish the objects aimed at when the original Committee was formed. After reading a paper on August 21, 1888, advocating the better protection of our native fauna and flora the late Mr. A. F. Robin moved the appointment of the Committee which was, I believe, the first with these objects in Australia. The late Professor R. Tate and Messrs. A. Zietz, S. Dixon, J. G. O. Tepper, and A. F. Robin (Secretary) were appointed; at the first meeting three or four days after I had the honour to be appointed Chairman, and after Mr. Robin had explained his views I suggested they could be effectively carried out only in a special area, and finally my resolution was carried to be placed before you—"That in furtherance of the proposed objects this Section desires to recommend that Government Farm be declared a Public Park and handed over to trustees to manage." I propose to summarize our further policy and deal with the Park question later. Our next step was to get an amended Game Bill providing for the partial protection of kangaroos and opossums, but it was rejected in the second reading without a division by the Legislative Council. The Commissioner of Crown Lands, however, agreed to circulate placards containing the chief provisions of the Game Act, and the police were instructed to secure their observance. Since then the Committee has year after year to acknowledge the sympathetic assistance rendered to our objective by the Under-Secretary for Lands (Mr. Thos. Duffield), and his cordial help we gratefully acknowledge. The same year we waited upon the Minister of Education requesting more direct instruction in schools in natural science, particularly as to insectivorous birds, and this was the beginning of the movement afterwards carried out in Victoria and at last carried out here under the able supervision of Mr. A. G. Edquist, B.Sc.; the future welfare of this State is largely bound up with habits of accurate observation and deduction inculcated thereby.

FORESTRY.

On various occasions by deputations and otherwise we have successfully protested against and prevented the alienation of our extremely small forest reserves by perpetual leases, which were too often granted, and we tried to secure for a natural redgum forest 11,000 acres at Mount Crawford, but they were unwisely let on miscellaneous leases. These are now nearly expired, and we confidently expect the realization of this scheme under the present Commissioner of Crown Lands, whose enlightened policy in this respect is a welcome contrast to that of some of his predecessors.

We were able in 1891 to secure an alteration of the Game Act providing for the protection of kangaroos in proclaimed areas, and Kangaroo Island was at once proclaimed, and subsequently Eyre Peninsula for three years; but the persistent poaching did not allow the natural increase to take place, and at the termination of every successive period the proclamation has been renewed.

The numerous alterations in Game Acts have involved a great deal of work, and the present Birds Protection Act is a very great improvement on previous legislation. Under these very successful efforts seals are now protected, and also the breeding places of seagulls, penguins, and mutton-birds—The Pages, Casuarina Island, Dangerous Reef, and the islands in Coffin Bay, Port Douglas, and Mount Dutton and Kellidie Bays. Much of our legislation and general policy have gradually been copied more or less in the other States, and all patriotic and well-informed public opinion in Australasia is in favour now of still further advances being made to secure the great principle of preservation of our native fauna and flora, and in this State we have particularly to acknowledge the assistance of the Press, especially from the very first of *The Register*, and on every occasion we have asked for it the active sympathy and support of the A.N.A. Under the provisions in the various Game Acts we have always contended for special areas as spheres for natural increase, and it has been a great pleasure to see Mr. Vaughan's wise use of them—the islands in the Coorong for waterfowl and Pearson's Island for its special wallaby.

Parks.

I now turn to the history of the Parks, the National Park at Belair and Flinders Chase, Kangaroo Island, which we confidently hope to see established in the near future, and in the expectant hope that the constitution of the latter will be an improvement on the first, which has taken twenty years to partially fulfil the objects we have so very strenuously fought for since 1888, hence some detail is necessary.

The immediate result of this section approving of my motion as above was the important deputation organized by Messrs. W. H. Selway and A. F. Robin to wait upon the Hon. T. Playford, then Premier, in October, 1888. It was introduced by the Hon. Sir E. T. Smith. We only obtained a promise "that reserves of this character will be made." The giving up of the Government Farm was strongly objected to, as it was wanted for workingmen's blocks, and, indeed, plans were then in the Land Office to carry out this policy, which was popular at the moment. Had our agitation been delayed this would without doubt have been carried out, as Mr. Walter Gooch's Act passed in 1883 necessitated only the sanction of the Parliament. It was particularly unfortunate that this Act had such a meagre scope, as in the intervening five years the Forest Department cut down £800 worth of redgum and denuded the western portion of the Farm of the magnificent trees, the growth of previous centuries, to the value of £800. The next year (1889) the report of the Surveyor-General said "a portion of the Government Farm with the Botanical and Zoological Gardens, as well as the acclimatization reserve (some 80 acres), should suffice for native fauna and flora." On July 29, 1890, Mr. Krichauff moved for the production of the Surveyor-General's Reports on National Parks. These contained

suggestions that 540 acres of Government Farm and other lands in the Onkaparinga, 3,250 acres in the vicinity of Mount Crawford, and 1,200 acres in various places should be set apart for our objects. In August Dr. Cockburn intimated that his Government approved of the reservation of the farm as a National Park. This followed upon the Public Service Commission report, but the Cockburn Government retiring it was necessary to organize another deputation. Mr. Alderman Bullock carried a motion in the City Council, and subsequently Mr. T. Worsnop (Town Clerk), acting with us, prepared a Bill vesting the whole area in trustees as a National Park. This measure was intrusted to the Hon. S. Tomkinson, but was not introduced owing to a technical question raised by the President. This deputation obtained an intimation from Mr. Playford that he was willing to set aside 1,700 acres, reserving 300 acres for workingmen's blocks. Our final effort in 1891 obtained Mr. Playford's promise, and the Act was assented to on December 19, 1891.

This Act provides for twelve Commissioners—seven *ex officio* and five appointed by the Government—and that of these appointees the two who attended the fewest meetings during the previous twelve months retire and the Government appoint two more. In practice this is a dead-letter, and although we have repeatedly endeavoured since my resignation in 1905 to obtain the appointment of two naturalists, so far we have failed, and two recent occurrences illustrate the harm resulting from the absence of expert guidance.

In 1909 our Committee learnt with much surprise and regret that firearms were habitually allowed in the Park, and in answer to remonstrances we were officially informed that "rabbits increased enormously; the shooting of rabbits had been permitted to approved persons, market-gardeners and others, on condition that the birds were not interfered with, and suggesting that city lads always had been a source of trouble to the Park, the railway line affording them every facility of shooting in the park and escaping along the line again before being caught." Two serious blunders are here evident; allowing rabbits to increase so greatly and disturbing a sanctuary for birds.

Again the latest report of the Commissioners says that "provision has been made for kangaroos by fencing in a small area of 40 acres abutting on Long Gully and near the reservoir, and that it was thought about £500 (! !) would cover the cost of fencing; but after the boundaries had been surveyed it was known that the above estimate would be exceeded owing to the rough hilly nature of the ground necessitating continual changes of grade, and the irregular shape of the piece of country selected considerably lengthening the line of fencing." The ground is unsuited for the purpose. It is a damp cold locality and altogether too rugged, for kangaroos (except the Euro, now nearly extinct, and the great dark wallaroo of New England) always prefer plain country, and how a flying doe can exhibit her marvellous speed in such a locality I do not in the least understand. The Upper Park is an ideal site, and very little further expense would have fenced in about 700 acres, affording ample room for emus, kangaroos, wallaby, bandicoot, etc., and have also protected that portion from the larrikin. I repeatedly endeavoured to get this done, but without success.

These details as to our part in the Park history have been rendered necessary by repeated assertions at variance with facts.

One of the strangest was contained in an account of the Park over the initials "R.O.C." in *The Register* of October, 1901, in which the whole credit for obtaining the Park—and with somewhat fulsome praise—was given to Mr. Walter Gooch, whose abortive Act of 1883 was actually ignored by the Government when Mr. Robin's paper originating this Committee was read. I wish in this place to bear testimony to Mr. Robin's active and ceaseless exertions as Secretary, for he not only organized three deputations but conducted a voluminous correspondence, colonial and abroad, and his resignation in 1895, followed by his long illness and death, was very deeply regretted by myself and colleagues. But the first idea of a Park originated in the late seventies or early eighties with Mr. James Page, of Mitcham, who became aware that the then Commissioner of Lands was taking steps to offer the Government Farm for sale. He went straight to the Chief Secretary, who at once put a stop to it, and thus the property was saved to the community. All these full details were printed in October 7, 1901, and a copy sent to each Commissioner. Hence they cannot plead ignorance of the true facts when they permitted a booklet to appear containing misleading statements, published by their authority last year, in which no mention whatever is made of the continuous and prolonged labours of my committee, quite forgetting the fact that Sir E. T. Smith and Mr. W. Gooch owe their appointments to our nomination.

Flinders Chase.

In 1893 the late Professor Tate, Mr. Robin, and myself attended the Hobart meeting of the Association for the Advancement of Science, and we carried my motion asking our Government to dedicate the Cape Border Lighthouse reserve for our objects. In 1896 the Marine Board reported to the Commissioner of Lands that the Cape Border reserve was required as affording fresh food to the keepers, but in 1906 we received a letter from the Secretary of the Marine Board asking for reasons why a lease of the reserve for a cattle-run should not be granted. On July 26 of that year a meeting was called by us in the Mayor's Parlour, the Mayor (the late Mr. Theo. Bruce) in the chair. After a sympathetic letter from His Honor Sir S. J. Way had been read I laid a scheme before the meeting for vesting in trustees the whole of the western end of Kangaroo Island. The speakers were Drs. Verco, Stirling, F.R.S., Rennie, and Rogers, also Messrs. W. H. Selway and Mellor, Councillor Isaacs, and Mr. Kreusler (A.N.A.). Subsequently on August 8 these gentlemen and others waited upon the late Hon. T. Price, who promised that the 67 square miles at Cape Border should be at once reserved, and that the Government was in full sympathy with us and would consider the request. Subsequently we presented a plan asking for all the land west of the line from Castle Hill due south, containing 300 square miles, and including Rocky River, Snug Cove, and several lagoons and smaller streams. Mr. Price requested a plan for appointing trustees, and we suggested eight trustees—one for each branch of natural history, namely, general zoology, ornithology, marine zoology, and botany, to be nominated by the University and the Royal Society respectively. At a subsequent interview arranged by Major Smeaton, Mr. Ashby and myself were informed that the lessees paying an annual rent of £28 10s. demanded in round

numbers £28,000 for compensation. We pointed out that the leases could be cancelled as required for parklands, but, unhappily, the Land Office subsequently granted on perpetual lease one-tenth of each lease, allowing the lessee to thus pick out

patches in various bays the country was inferior. At Rocky River there was 1,500 acres of fair country, most of it heavily timbered, and he could not advise people to settle for agricultural purposes, and it was indifferent from a pastoral point of view." Professor Angus said the central ridge was a solid block of ironstone fit for nothing. We cannot but regret that the cancellation clause was not acted on. The perpetual leasees have since asked very many times the value of what they wanted before we waited on Mr. Price. When Mr. Coombe was Commissioner he granted an additional 79 square miles. In May of this year an extremely large and important deputation waited upon the Commissioner for Lands. It was introduced by Major Smeaton and the late Hon. Theo. Bruce, and was of an Australasian character, including as it did representatives from the Sydney and Melbourne Universities and the various State scientific societies, and South Australian Societies, Corporations, and District Councils. The Hon. C. Vaughan said the Government had every sympathy with our request to secure the whole 300 square miles, and something more must be done than had hitherto been done. He would make a recommendation to his colleagues, but the extent of it would be a matter for consideration and he would make a personal inspection. He thought it would be necessary to introduce a Bill to define the powers granted in connection with the reserve, and would provide in the Estimates for a vermin-proof fence.

In this advanced condition we hopefully look forward to the completion of an invaluable scheme, invaluable to the scientists of the world and of the very greatest value as a sanatorium and centre for biological studies, attracting visitors from the civilized world when the complete realization of our ideals takes place. It is of the greatest importance to its success that the error made by Parliament be avoided in altering our programme for the National Park, that the scientific bodies with their specialists should nominate the preponderating elements in the new governing body, having no *ex-officio* members or others who have no special knowledge of or interest in natural history.

Work for the Future.

After twenty-three years of pioneering work very much requires to be done, and it may be useful to outline a programme of what remains for the lovers of our extremely beautiful and unique flora and fauna to preserve both from irremediable destruction.

In both directions a good healthy public feeling has been cultivated in old and young, and from the latter especially the indications for an intelligent and appreciative knowledge of the importance of the subject economically may be hopefully expected. In all the States there now exist some legislation and interest, and this requires guidance. We are fortunate here at present in having the Hon. Crawford Vaughan as Commissioner of Lands.

Not one of his predecessors has shown anything like the sympathy he has with our object, but a strong Society is needed to see that the law is carried out when made. The Kangaroo Protection Act, for instance, has been violated systematically for years by the cupidity of the ignorant. The Birds Protection Act everywhere needs volunteer observers to enforce its provisions and a central authority to meet the cost of and enforce prosecutions. In the botanical section of knowledge there is an enormous field for the propagation of knowledge to prevent the utter disappearance of many species of the greatest importance to the world of knowledge. It appears to me that a Society for the Conservation of our Fauna and Flora is greatly needed, and with the increased public interest which we have done our best to cultivate in the past ample funds could be obtained by appealing to rich Australians. Such a Society could by the appointment of life members and annual subscriptions obtain an income sufficient to publish literature, encourage original observation and experiments, undertake prosecutions, and when the Flinders Chase is in the hands of trustees stock it with birds and animals and cultivate plants now nearing extinction.

Visitors to Australia, if scientists, note the amazing absence of native plants, shrubs, and trees. The suggested Society could by obtaining seeds and plants for public parks and private gardens wipe off this reproach. It is never realized how near to extinction some representative species are. A notable example is *Newcastlia Dixoni*, a dense-growing bush up to 4 ft. high, with sage-like leaves. I found one single plant in a chain road near Crystal Brook twenty-five years ago. Professor Tate subsequently got a specimen from Cal Lal, New South Wales, and Baron Von Müller had a single leaf from north-west Victoria. Then there is the Alexander palm confined to about 150 trees in Glen Helen and the Western Australian eucalypti, such as *E. ficifolia*, *E. tetraaptera*, and *E. funeralis*, are but very limited in distribution. The first and last were originally confined to a square mile or two. Botanists are aware of many more equally scarce. These instances suffice to illustrate the need of conserving and cultivating our rarer plants. In the Melbourne Gardens Mr. Guilfoyle collected many native species, and Mr. Maiden is doing the same in Sydney; but anything like an adequate collection of the flowers, shrubs, and trees I have not seen in any State in Australia. I hope Australia will yet produce a gardening genius who will utilize the amazing potentiality for producing unequalled landscape beauties by grouping such extraordinary contrasts of growths, foliage, and colour as are to be obtained from the wonderful variety in each State of Australia. In our State take the *Exocarpos*, vulgarly native-cherry. What greater contrast could be desired than *E. cupressiformis*, with *E. stricta* and E. *sparta*, the latter very abundant at Streaky Bay, its long pendant twigs forming a veritable cataract of pale-green gracefully waving in the breeze? Then again the wattles. What glorious contrasts exist between the desert forms, all spines and thorns, and the broad phylodes of *A. pycnantha*, the brilliant bluish grey foliage of *A. spillerani*, and the Queensland *A. podalyriæfolia*. The drooping foliage of the scented Myal, *A. pendula*, as upright as a Lombardy poplar, in outline up to 30 ft. in height; or the Broughton willow *A. salicina* contrasted with *A. dealbata* or *A. decurrens*, and the stiff spare foliage of *A. aneura* (mulga).

Then our eucalypti contrast of vivid-coloured flowers, crimson, scarlet, deep-pink and creamy-white, varying in height from 3 to 300 ft.; the casuarinas, some stiff and rigid, others gracefully drooping Our Caper trees, especially *Capparis Mitchelli*, with thick dense masses of leaves and large whitish-yellow blooms, the brilliant flowered *Hibiscus Hugelii* or the yellow *H. lakaafolia* blooming most in hottest weather; the rare desert *Sterculia Gregorii*, with brilliant pale-green dense foliage. All these, with innumerable others, are peculiar and endemic to Australia.

Difficulties there are to be surmounted, and by money grants the proposed Society could surmount them—difficulties arising from our ignorance of the mineral requirements of the soil and the conditions needed to propagate them. Take *Exocarpos*, believed to be parasitic in its youth, a point yet to be proved. And the same applies to *Nuytsia floribunda*, the brilliant orange-flame coloured Christmas-tree of Western Australia. If one or two of our numerous parks surrounding Adelaide were set apart to grow desert forms and cultivate with due knowledge and insight into the landscape requirements the rarer casuarinas, eucalypts, melaleucas, sterculias, and acacias it would soon become famous throughout the world and its growing reputation greatly increased for singular beauty. No other capital city of Australasia has our natural advantages, and many of those rare curious growths from desert regions will not grow with them. A due appreciation and knowledge of our own flora and its æsthetic qualities would have prevented the intended rockeries on North Terrace, almost sure to become "ratteries" bye and bye. These rockeries suit St. Kilda Road, in Melbourne, but how monotonous and wearying to the eyes is the Alexandra Drive along the Yarra, how commonplace and artificial compared with its lovely shady native growths of forty years ago with hundreds of water-fowl in the Princes Bridge lagoon. It has been said of North Terrace that the soil is poor. So it is for exotic vegetation common to all warm climates, but it is rich and suitable for many of our indigenous Australians. To me it seems unfortunate that the distinctive beauties peculiarly Australian should be sacrificed to uniform imitation of European gardens, palling to the eyes by their mechanical repetitions.

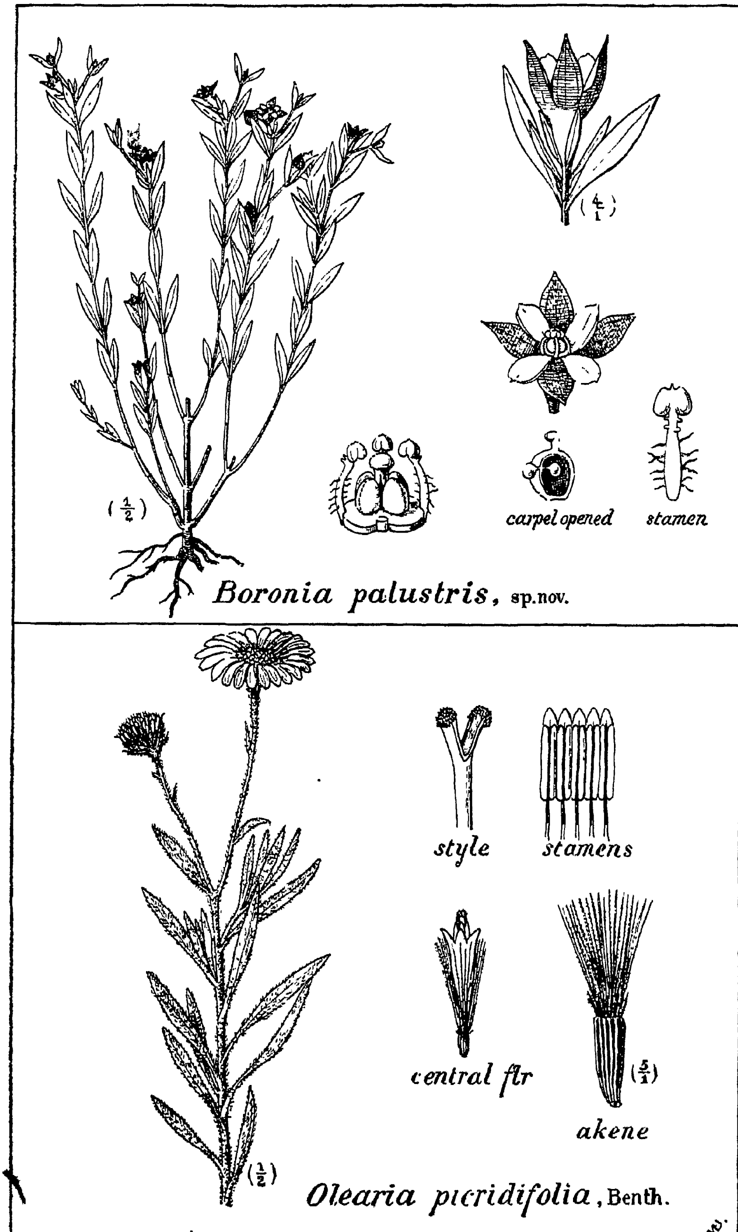
One large section of natural history is now splendidly cared for by the Ornithological Society, the members of which are to be heartily congratulated on the successful transportation of the mallee hen (Leipoa) to Flinders Chase. I feel sure of their cordial help and assistance if the proposed Society provides the funds to secure that inimitable joker and mimic the lyre-bird (Malura). If that is once established on Kangaroo Island no other bird can equal it in attractiveness. I trust, too, that Captain White and Mr. Mellor will add the brush turkey also, and as opportunity arises all the ground-nesting birds suited to the island climate.

I cannot hope to see the full fruition of these ideals, but trust the rising generation will hand on the torch, and though much of the continent is despoiled and vulgarized, and my successors cannot enjoy the delightful wanderings in unstocked, unspoilt Australia which I have had, still increasing knowledge in science will compensate them for the deprivation, and there yet are rare plants to be found and named which invite the rambler and lover of wild nature to cast off the trammels of luxury and spend his holidays in the solitary bush.

GENERAL INDEX.

[Generic and specific names printed in italics indicate that the forms described are new.]

PLATES I. TO XXVII.



Boronia palustris, sp.nov.

Olearia picridifolia, Benth.

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View of Swanport, looking South from the southern end of the Swamp, which is seen in the foreground.

Hussey & Gillingham Limited, Printers, Adelaide.

The Cutting in its condition on April 14, 1911, taken from a point nearer to it than in Plate ii.

Hussey & Gillingham Limited, Printers, Adelaide.

Exposed face of the Cutting from a near point

Hussey & Gillingham Limited, Printers, Adelaide.

Another view of face of Section, showing line of demarcation between kitchen-midden deposit and subjacent layer of red sand.

Hussey & Gillingham Limited, Printers, Adelaide

Mrs Karpeny

Hussey & Gillingham Limited, Printers Adelaide

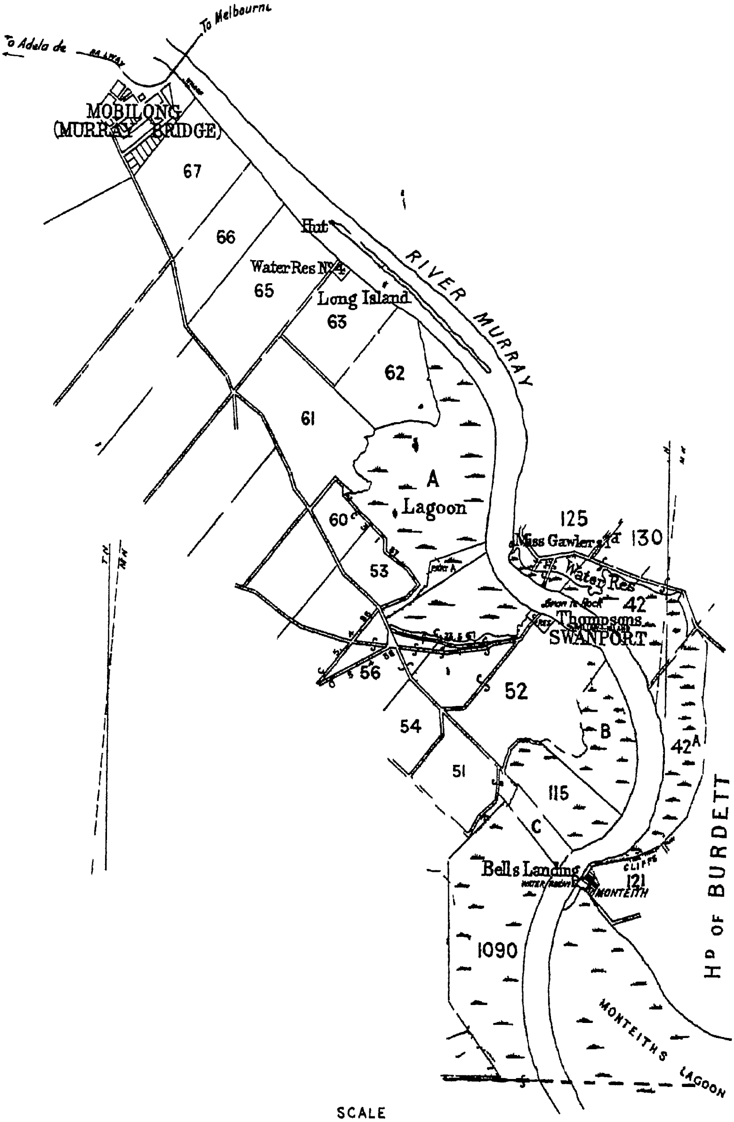
Mrs. Karpeny.

Hussey & Gillingham Limited, Printers, Adelaide

Mrs Karpeny

Hussey & Gillingham Limited Printers Adelaide

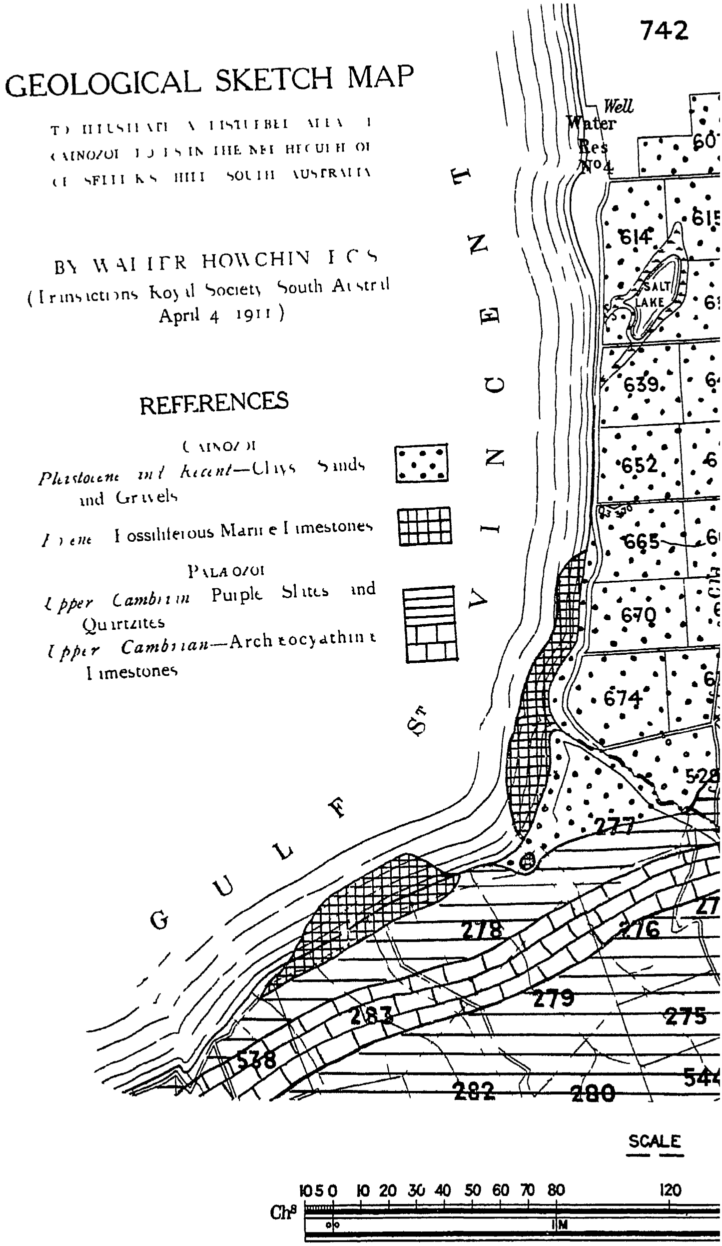
H^D. OF MOBILONG



SCALE

Chs 10 0 10 20 30 40 50 60 70 80 160 240 Chains

A VAUGHAN GOVERNMENT PHOTO THOGRA HER ADELA DE


GEOLOGICAL SKETCH MAP
TO ILLUSTRATE A DISTURBED AREA OF CAINOZOIC BEDS IN THE NEIGHBOURHOOD OF SELLICKS HILL SOUTH AUSTRALIA
BY WALTER HOWCHIN F.G.S.
(Transactions Royal Society South Australia April 4 1911)
REFERENCES
CAINOZOIC
Pleistocene and Recent—Clays Sands and Gravels
Eocene Fossiliferous Marine Limestones
PALAEOZOIC
Upper Cambrian Purple Slates and Quartzites
Upper Cambrian—Archaeocyathinae Limestones
GULF ST VINCENT
Well
Water Res No 4
SALT LAKE
614
615
639
652
665
670
674
528
277
278
276
279
275
283
538
282
280
544
SCALE
Chs
10 5 0 10 20 30 40 50 60 70 80 120
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1 M

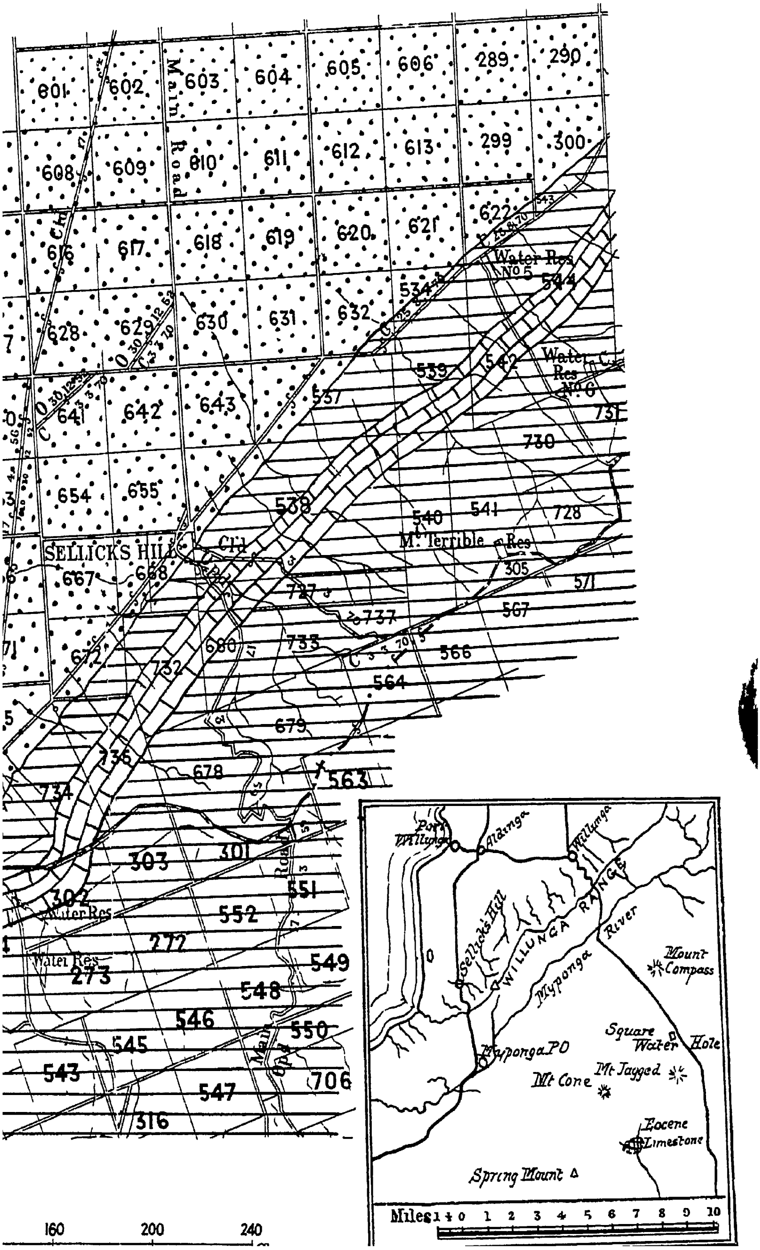
Main Road
SELLICKS HILL
Water Res No 5
Water Res No 6
Mt Terrible Res
Water Res
Water Res
Main Road
160
200
240
Port Willunga
Aldinga
Willunga
Sellick's Hill
WILLUNGA RANGE
Myponga River
Mount Compass
Square Water Hole
Myponga P.O.
Mt Jagged
Mt Cone
Eocene Limestone
Spring Mount
Miles 1 ½ 0 1 2 3 4 5 6 7 8 9 10

Photo by W Howchin

The Willunga Valley, with great Fault Scarp of the Willunga Ranges in the distance

Hussey & Gillingham Limited Printers, Adelaide

Photo by W. Howchin

Tilted Lower Cainozoic Rocks resting unconformably on Cambrian Slates

Hussey & Gillingham Limited, Printers, Adelaide

Photo by W Howchin

Folded Lower Cainozoic Rocks in Sea Cliffs looking north

Hussey & Gillingham Limited Printers Adelaide

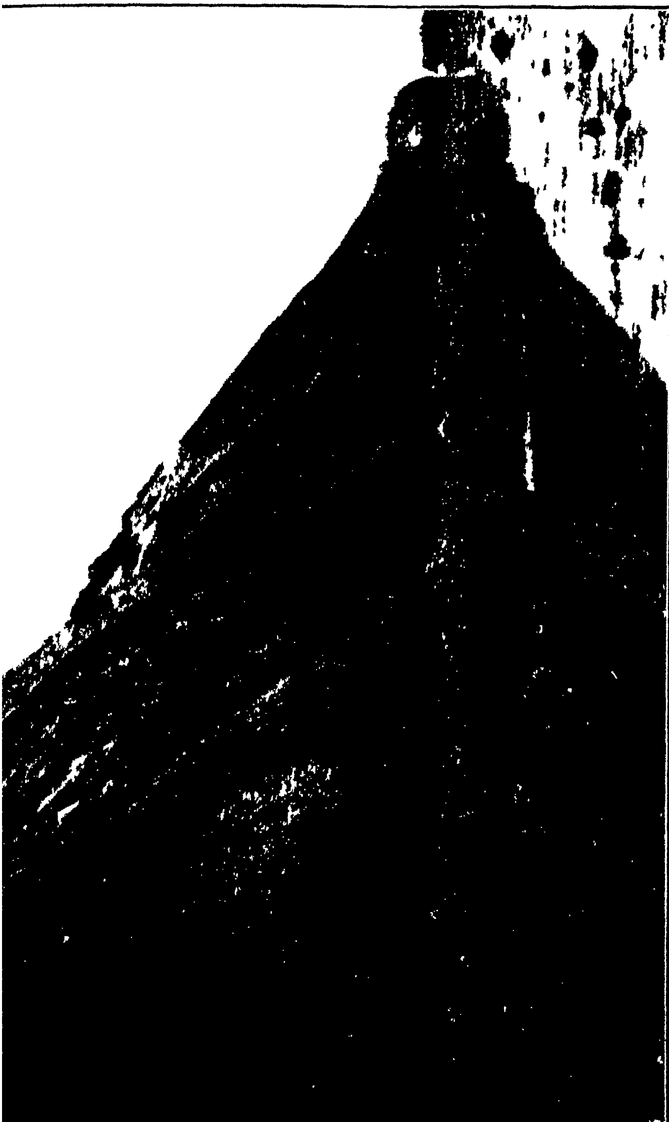

Photo by H Howchin
General view of Lower Cainozoic Rocks forming Sea Cliff with a High Angle of Dip looking south

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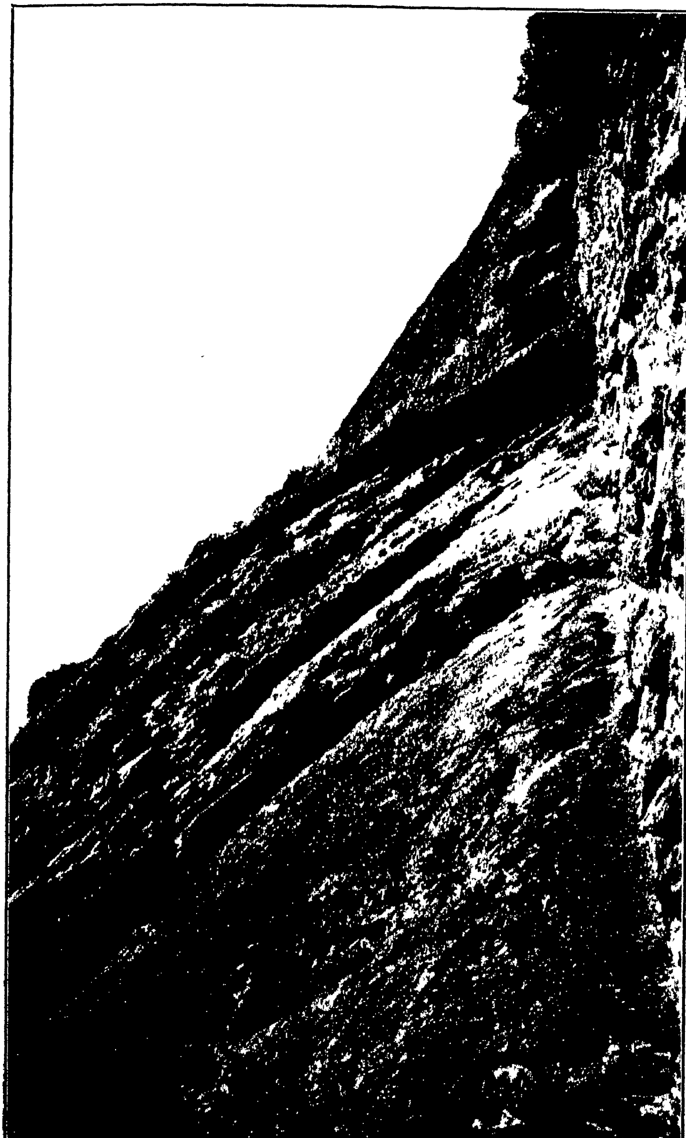

Photo. by W. Howchin

Near view of Cliffs shown in Plate XIV.

Hussey & Gillingham Limited, Printers, Adelaide.

Photo by H Houchin

Lower Cainozoic Rocks strongly tilted, occupying Spur of Cliffs, looking north

Hussey & Gillingham Limited Printers Adelaide

Photo by W Howchin

Contorted Lower Cainozoic Rocks forming isolated Pedestal on Beach

Hussey & Gillingham Limited, Printers, Adelaide

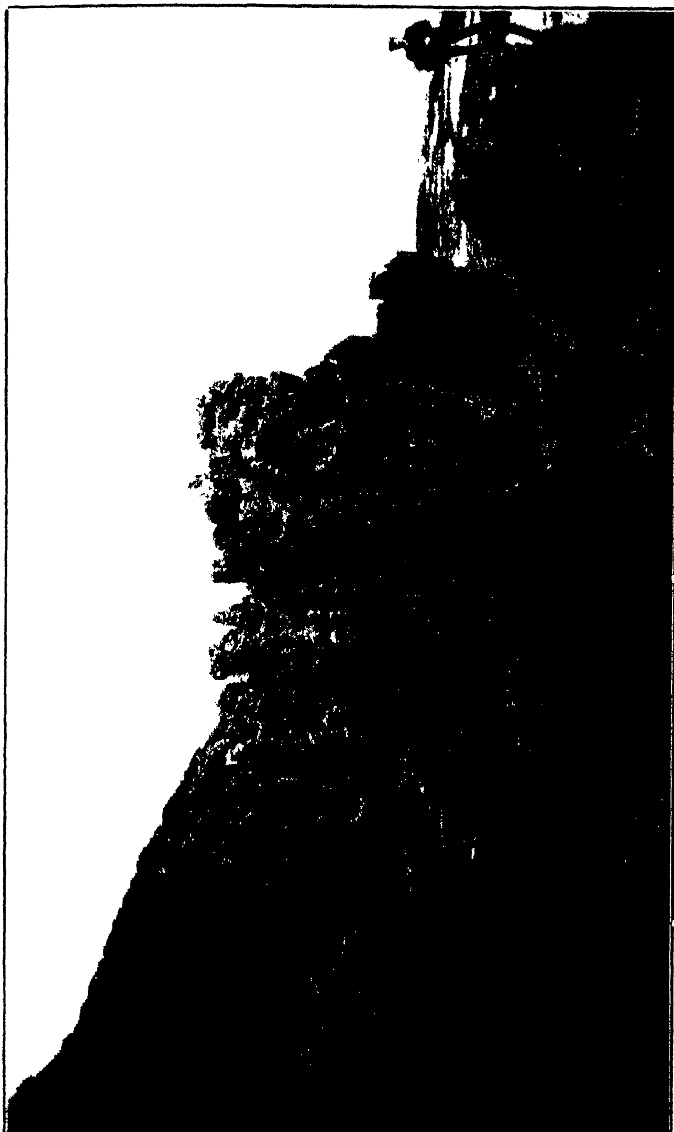

Photo. by W Howchin

Vertical and Reversed Folds of Lower Cainozoic Rocks on Beach.

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Thrust Plane in Lower Cainozoic Rocks looking south

Photo by H H [illegible]

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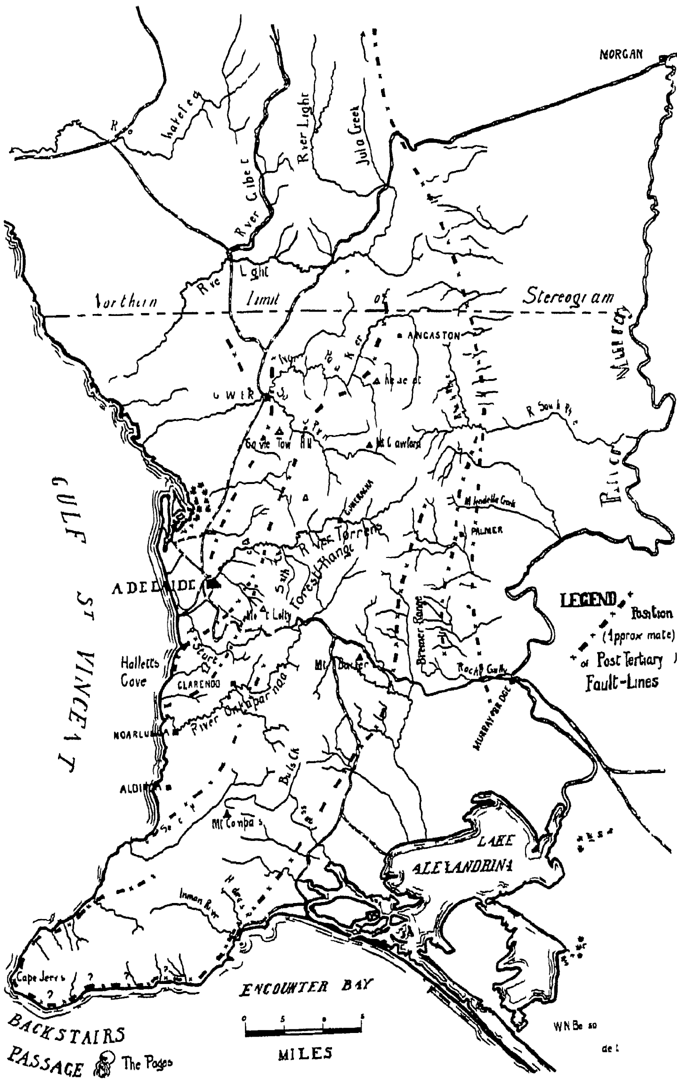
MORGAN
River Gilbert
River Light
Stereogram
ANGASTON
GULF ST VINCENT
ADELAIDE
River Torrens
Mt Lofty
Halletts Cove
CLARENDON
River Onkaparinga
NOARLUNGA
ALDINGA
Mt Barker
PALMER
Breamer Range
MURRAY BRIDGE
LEGEND
Position (Approximate) of Post Tertiary Fault-Lines
LAKE ALEXANDRINA
Inman River
Cape Jervis
ENCOUNTER BAY
BACKSTAIRS PASSAGE
The Pages
MILES

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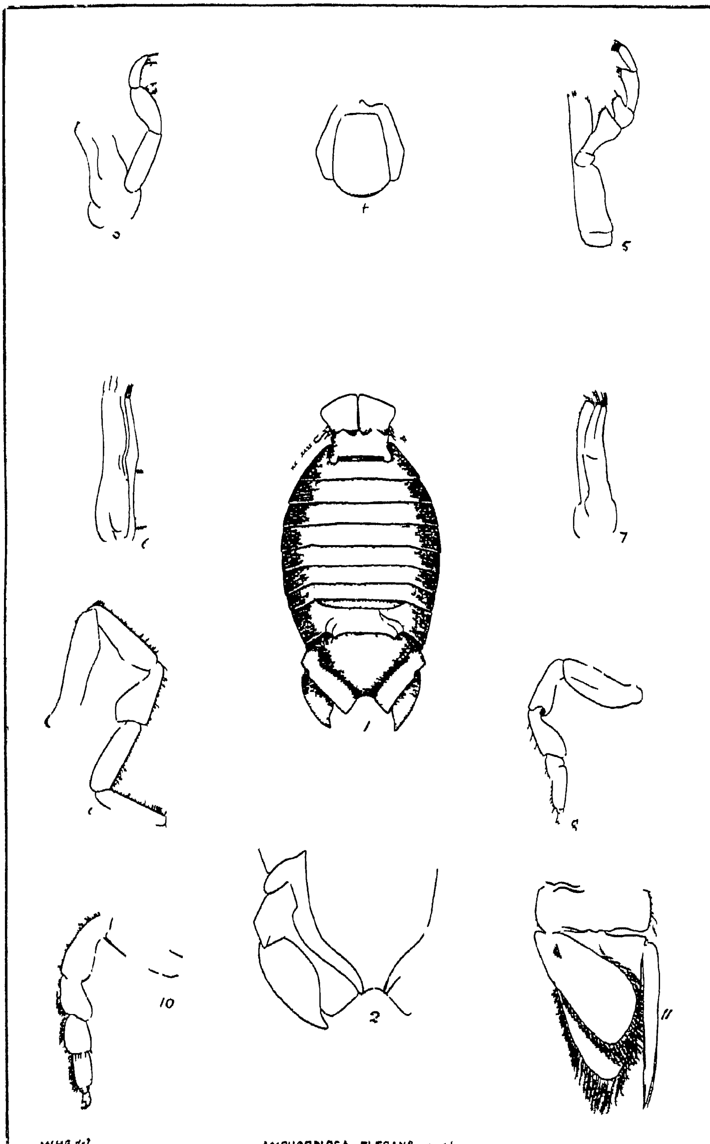
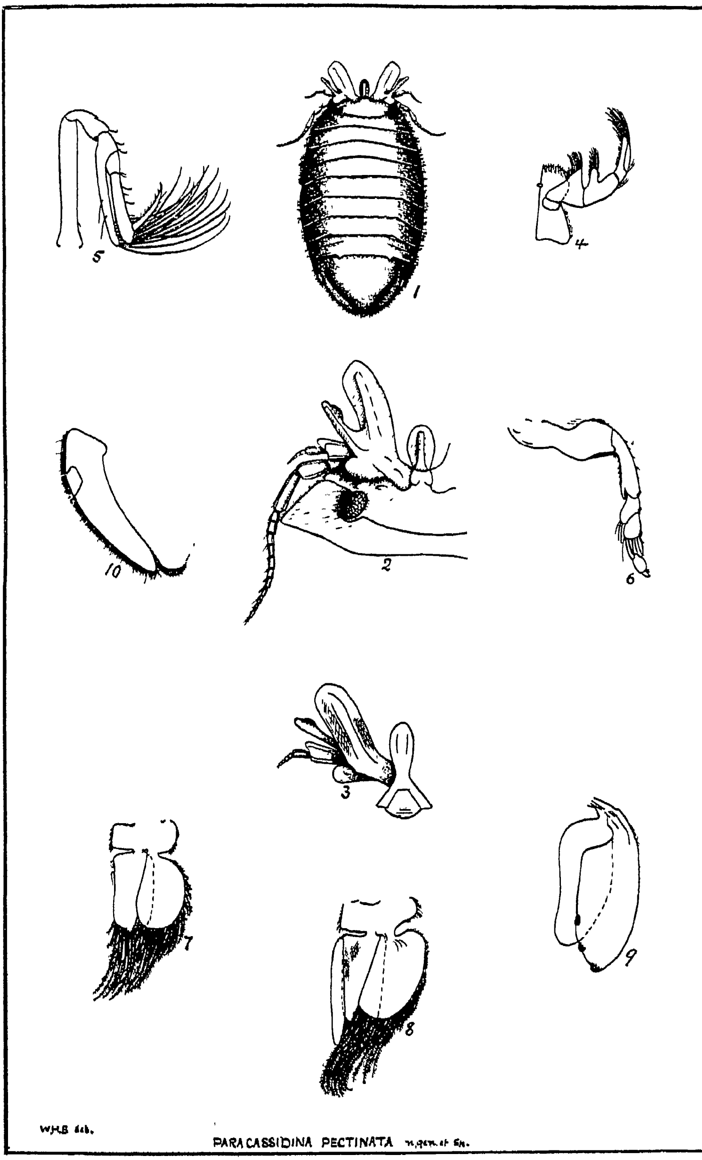

WHB del
AMPHOROIDEA ELEGANS n. sp.



PARACASSIDINA PECTINATA n. gen. et sp.

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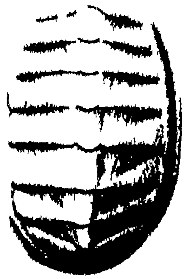

1A

1B

1C

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1E

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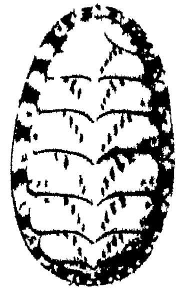

2A

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2C

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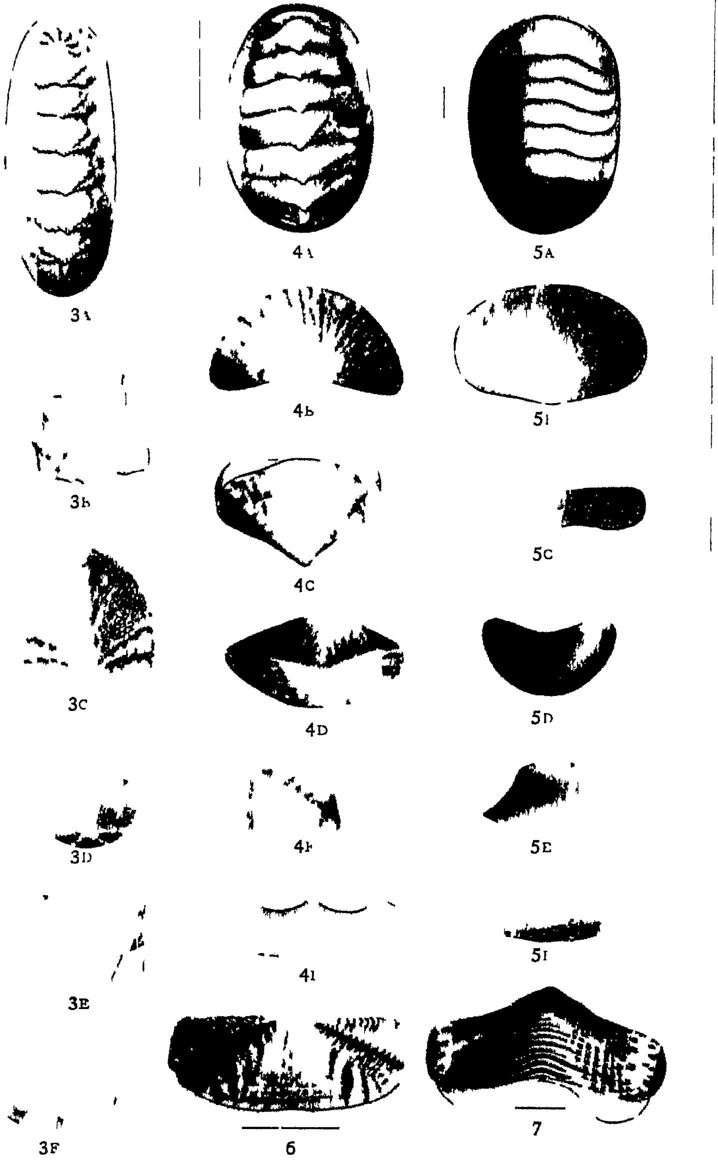
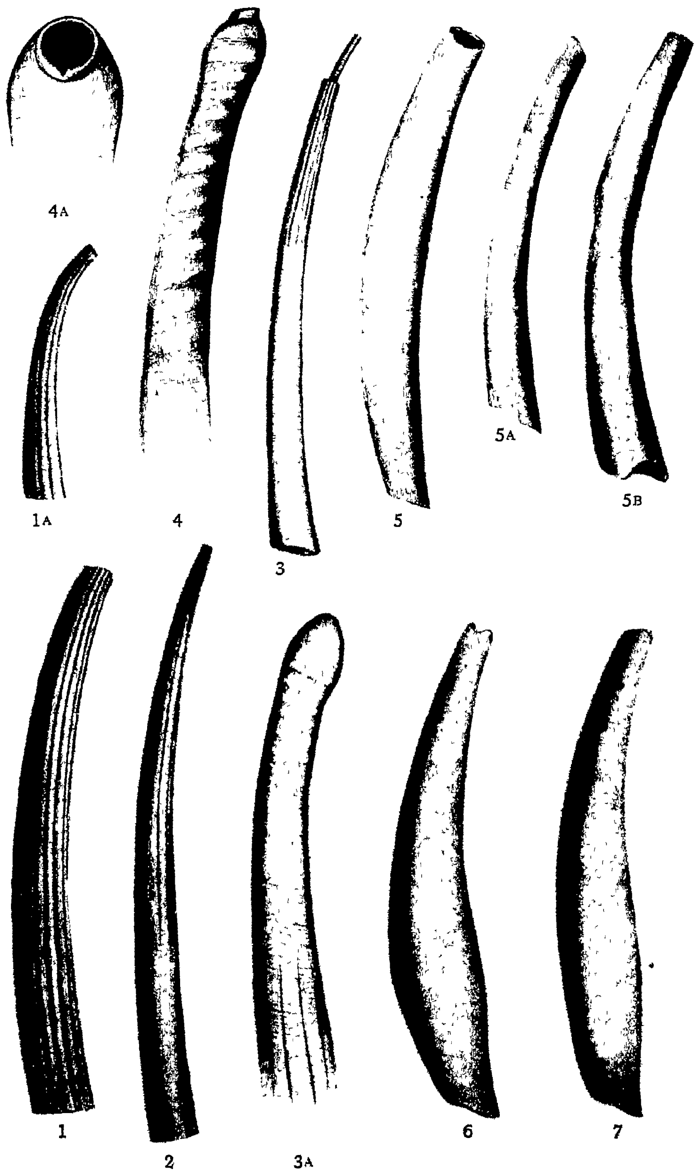
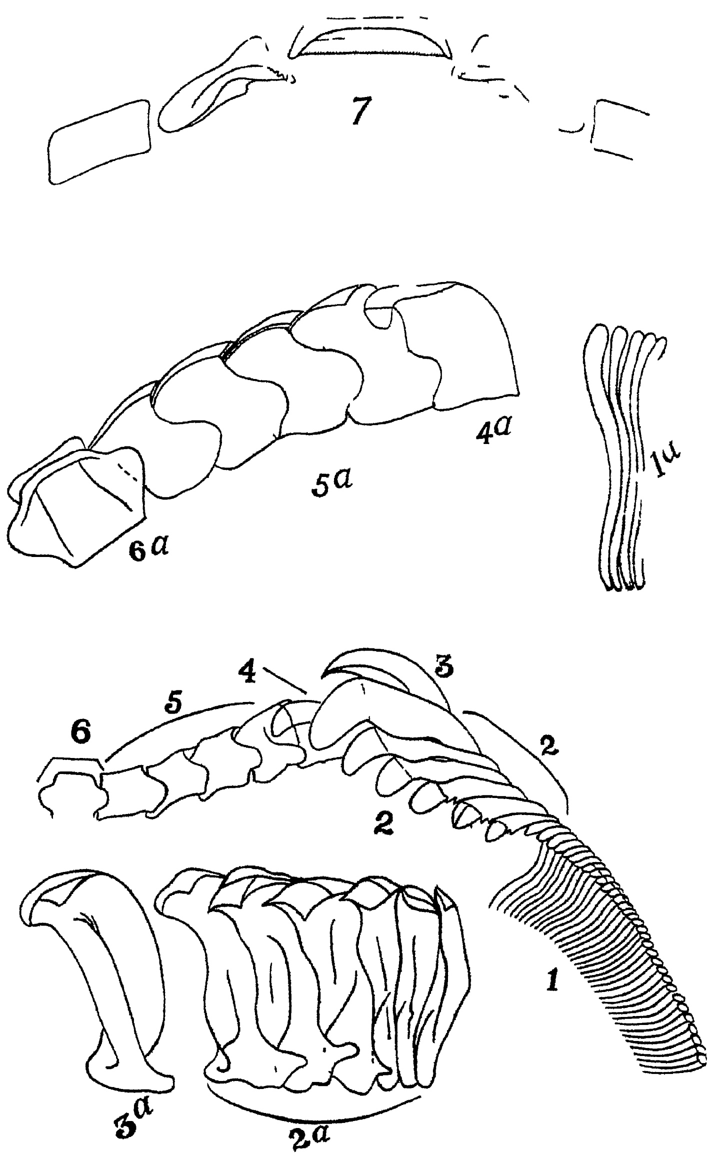
2E

2F


3A
4A
5A
4B
5B
3B
4C
5C
3C
4D
5D
3D
4E
5E
3E
4F
5F
6
7
3F


4A
1A
4
3
5
5A
5B
1
2
3A
6
7


7
4a
5a
6a
1a
4
3
5
6
2
2
1
3a
2a